



**Australian Government**

# **MEM05 Metal and Engineering Training Package**

**Release: 11.1**

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MEM19003B Handle gem materials .....	3396
MEM19004B Handle and examine gemstone materials .....	3403
MEM19005B Produce three-dimensional precision items.....	3410
MEM19006B Replace watch batteries .....	3417
MEM19007B Perform gemstone setting .....	3423
MEM19008B Prepare jewellery designs .....	3429
MEM19009B Perform investment procedures for lost wax casting process .....	3437
MEM19010B Produce rubber moulds for lost wax casting process .....	3443
MEM19011B Perform wax injection of moulds for lost wax casting process .....	3449
MEM19012B Produce jewellery wax model.....	3454
MEM19013B Produce jewellery metal masters .....	3460
MEM19014B Perform hand engraving.....	3467
MEM19015B Perform jewellery enamelling .....	3473
MEM19016B Construct jewellery components.....	3480
MEM19017B Fabricate jewellery items .....	3486
MEM19018B Repair jewellery items .....	3494
MEM19020B Fault-find and maintain micro-mechanisms .....	3502
MEM19021B Diagnose and service micro-mechanisms .....	3509
MEM19022B Perform precision micro-mechanism diagnosis and servicing.....	3516
MEM19023A Apply drawing and rendering techniques to jewellery or object design..	3523
MEM19024A Use CAD to create and display 3D jewellery and object models .....	3528

MEM19025A Create and present designs for jewellery and other 3D objects.....	3534
MEM19026A Investigate quality and application of jewellery materials .....	3541
MEM19027A Produce life drawings for presenting jewellery and object designs .....	3548
MEM19028A Select materials and new technologies for jewellery and 3D object design applications.....	3553
MEM19029A Produce a professional jewellery design and 3D object portfolio .....	3560
MEM19030A Research and design sustainable objects.....	3565
MEM19031A Produce renderings and technical drawings for jewellery and object design construction.....	3571
MEM19032A Design and implement mechanisms in jewellery items.....	3576
MEM19033A Create silversmithing objects.....	3582
MEM19034A Apply chain manufacture process.....	3588
MEM19035A Plan and apply casting techniques for jewellery and object designs.....	3594
MEM19036A Use specialised techniques to produce jewellery and objects.....	3600
MEM19037A Plan and implement chain fabrication process .....	3607
MEM19038A Apply traditional techniques to jewellery and 3D object production .....	3613
MEM19039A Plan, conduct and supervise a jewellery and object exhibition.....	3618
MEM19040A Create and manufacture jewellery or object design prototypes for the mass market.....	3626
MEM19041A Experiment with jewellery or object designs .....	3633
MEM19042A Render images using computer graphics software .....	3640
MEM19043A Oversee jewellery or object design production .....	3646
MEM19044A Repair and restore antique jewellery.....	3652
MEM19045A Set gems in channel style settings.....	3659
MEM19046A Apply grain setting techniques .....	3666
MEM19047A Set gems in claw and bezel style settings.....	3673
MEM19048A Develop and apply complex borders and decorations for hand engraving.....	3680
MEM19049A Develop and apply heraldic designs for hand engraving.....	3687
MEM19050A Hand carve engraving work .....	3694
MEM19051A Construct multiple stone settings.....	3700
MEM19052A Produce complex objects using silversmithing techniques .....	3706
MEM19053A Create complex findings and mechanisms for jewellery items .....	3713
MEM19054A Fabricate platinum jewellery items.....	3720
MEM20001A Produce keys .....	3727
MEM20002A Assemble and test lock mechanisms.....	3734
MEM20003A Install and upgrade locks and hardware.....	3741
MEM20004A Gain entry .....	3749
MEM20005A Install and maintain door control devices/systems .....	3756
MEM20006A Maintain and service mechanical locking devices.....	3765
MEM20007A Plan and prepare a masterkey system .....	3774
MEM20008A Develop and implement a masterkey system.....	3781
MEM20009A Gain entry and reinstate fire and security containers .....	3788
MEM20010A Gain entry and reinstate automotive locking systems .....	3797
MEM20011A Service and repair fire and security containers.....	3805
MEM20012A Service and repair mechanical automotive locking systems .....	3814
MEM20013A Service automotive transponder systems .....	3823
MEM20014A Perform a site security survey .....	3831
MEM21001A Replace watch batteries, capacitors and bands.....	3840
MEM21002A Perform watch movement exchange .....	3848
MEM21003A Perform watch case servicing, repair and refurbishment .....	3856
MEM21004A Clean watch and clock components .....	3865
MEM21005A Diagnose faults in quartz watches.....	3872
MEM21006A Service quartz watches .....	3879

MEM21007A Service complex quartz watches .....	3886
MEM21008A Service mechanical watches .....	3894
MEM21009A Inspect, diagnose, adjust and repair mechanical watches .....	3903
MEM21010A Service watch power generating systems .....	3911
MEM21011A Service calendar and other dial indication mechanisms for watches.....	3919
MEM21012A Service and repair mechanical watch oscillating systems.....	3926
MEM21013A Service, test and adjust watch escapements .....	3935
MEM21014A Service mechanical chronograph watches.....	3942
MEM21015A Perform precision watch timing and adjustment.....	3950
MEM21016A Install and set up clocks.....	3958
MEM21017A Service and repair clock timepieces.....	3966
MEM21018A Service clock escapements and oscillating systems.....	3976
MEM21019A Service and repair clock striking mechanisms .....	3983
MEM21020A Service and repair clock chiming mechanisms.....	3991
MEM21021A Restore clockwork mechanisms .....	4000
MEM21022A Manufacture watch and clock components.....	4008
MEM21023A Plan, set up and operate horological workshop or service centre .....	4015
MEM22001A Perform engineering activities .....	4022
MEM22002A Manage self in the engineering environment .....	4029
MEM22007A Manage environmental effects of engineering activities .....	4037
MEM22012A Coordinate resources for an engineering project or operation.....	4044
MEM22013A Coordinate engineering projects.....	4052
MEM22014A Coordinate engineering-related manufacturing operations .....	4061
MEM22015A Source and estimate engineering materials requirements .....	4070
MEM22017A Coordinate continuous improvement and technical development.....	4078
MEM22018A Coordinate sales and promotion of engineering-related products or services	4086
MEM23003A Operate and program computers and/or controllers in engineering situations.....	4094
MEM23004A Apply technical mathematics .....	4101
MEM23005A Apply statistics and probability techniques to engineering tasks .....	4107
MEM23006A Apply fluid and thermodynamics principles in engineering.....	4113
MEM23007A Apply calculus to engineering tasks.....	4121
MEM23008A Apply advanced algebra and numerical methods to engineering tasks ...	4127
MEM23052A Apply basic electro and control scientific principles and techniques in aeronautical engineering.....	4134
MEM23063A Select and test mechanical engineering materials .....	4139
MEM23064A Select and test mechatronic engineering materials.....	4147
MEM23073A Select and apply aeronautical engineering methods, processes and construction techniques .....	4155
MEM23074A Select and apply avionic engineering methods, processes and construction techniques.....	4162
MEM23084A Apply scientific principles and techniques in aeronautical engineering situations.....	4170
MEM23086A Apply scientific principles and techniques in avionic engineering situations	4178
MEM23095A Apply aeronautical system design principles and techniques in aeronautical engineering situations .....	4186
MEM23096A Apply avionic system design principles and techniques in avionic engineering situations .....	4192
MEM23097A Apply automated systems principles and techniques in aeronautical engineering situations .....	4198
MEM23098A Apply automated systems principles and techniques in avionic engineering situations.....	4205
MEM23109A Apply engineering mechanics principles.....	4213

MEM23111A Select electrical equipment and components for engineering applications	4221
MEM23112A Investigate electrical and electronic controllers in engineering applications	4230
MEM23113A Evaluate hydrodynamic systems and system components	4237
MEM23114A Evaluate thermodynamic systems and components	4244
MEM23115A Evaluate fluid power systems	4251
MEM23116A Evaluate programmable logic controller and related control system component applications	4259
MEM23117A Evaluate microcontroller applications	4267
MEM23118A Apply production and service control techniques	4275
MEM23119A Evaluate continuous improvement processes	4284
MEM23120A Select mechanical machine and equipment components	4293
MEM23121A Analyse loads on frames and mechanisms	4301
MEM23122A Evaluate computer integrated manufacturing systems	4310
MEM23123A Evaluate manufacturing processes	4319
MEM23124A Measure and analyse noise and vibration	4329
MEM23125A Evaluate maintenance systems	4338
MEM23126A Evaluate industrial robotic applications	4349
MEM23129A Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration	4358
MEM23130A Coordinate servicing and fault-finding of HVACR control systems	4367
MEM23131A Evaluate rapid prototyping applications	4376
MEM23132A Evaluate rapid manufacturing processes	4385
MEM23133A Evaluate rapid tooling applications	4394
MEM23134A Evaluate jigs and fixtures	4403
MEM23135A Evaluate moulding tools and processes	4412
MEM23136A Evaluate stamping and forging tools	4421
MEM23137A Evaluate rolling tools and processes	4429
MEM23138A Evaluate suitability of materials for engineering-related applications	4437
MEM23139A Design a basic single zone duct distribution system	4444
MEM23140A Determine operational parameters for building HVAC hydronic systems	4451
MEM23141A Complete a building thermal performance survey	4458
MEM23142A Determine psychrometric processes and system performance	4466
MEM23143A Apply energy management principles	4473
MEM23144A Contribute to the design of a commercial refrigeration system	4480
MEM23145A Apply codes and regulations to air conditioning designs	4487
MEM23146A Contribute to the design of industrial refrigeration systems	4493
MEM23147A Contribute to the design of hydronic systems	4499
MEM23148A Develop energy management solutions	4505
MEM23149A Contribute to the design of commercial and industrial exhaust systems	4511
MEM23150A Contribute to the design of heating systems	4518
MEM23151A Commission and optimise performance of HVACR systems	4525
MEM23152A Apply principles of refrigeration food storage technology	4532
MEM23153A Contribute to the design of heat exchanger systems	4539
MEM23154A Analyse and service HVACR systems	4545
MEM234001A Plan and manage engineering-related projects or operations	4552
MEM234002A Integrate engineering technologies	4561
MEM234003A Design machines and ancillary equipment	4569
MEM234004A Design for engineering-related noise and vibration mitigation	4576
MEM234005A Design hydrodynamic pumping systems	4583
MEM234006A Evaluate and select thermodynamic systems or subsystems	4590
MEM234007A Design fluid power systems	4597
MEM234008A Design plant using computer simulations	4605
MEM234009A Design computer-integrated manufacturing systems	4613

MEM234010A Design microcontroller applications .....	4621
MEM234011A Design programmable logic controller applications .....	4628
MEM234012A Design integrated maintenance management systems .....	4635
MEM234013A Plan and design engineering-related manufacturing processes .....	4646
MEM234014A Design a robotic system .....	4655
MEM234015A Design hydronic heat exchanger systems .....	4662
MEM234016A Design refrigeration systems .....	4668
MEM234017A Design exhaust, ventilation and dust collection systems .....	4674
MEM234018A Design heating, ventilation, air conditioning and refrigeration control systems .....	4680
MEM234019A Apply finite element analysis in engineering design .....	4688
MEM234020A Coordinate small lot manufacture using rapid manufacture processes .....	4695
MEM234021A Apply statistics to technology problems .....	4702
MEM234022A Apply advanced calculus to technology problems .....	4708
MEM234023A Apply differential equations to technology problems .....	4714
MEM234024A Apply advanced mathematics in technology problems .....	4720
MEM234025A Apply numerical methods to technology problems .....	4727
MEM234026A Develop and coordinate engineering-related contingency plans .....	4733
MEM234027A Plan and manage materials supply for an engineering project or manufacturing operation .....	4740
MEM234028A Produce and manage technical documentation .....	4749
MEM234029A Produce and manage technical publications .....	4756
MEM234030A Provide specialised technical and engineering guidance to other technical employees .....	4764
MEM234031A Manage installation, commissioning or modification of machines and equipment .....	4771
MEM234032A Manage fluid power related technologies in an enterprise .....	4779
MEM234033A Lead engineering-related quality operations in an enterprise .....	4788
MEM234034A Manage heating, ventilation, air conditioning and refrigeration systems or projects .....	4797
MEM234035A Maintain and apply technical and engineering skills .....	4806
MEM234036A Apply configuration management procedures in engineering project management .....	4815
MEM234037A Perform maintenance-related integrated logistic support management activities .....	4823
MEM234038A Apply systems engineering procedures to engineering design project management .....	4830
MEM24001B Perform basic penetrant testing .....	4837
MEM24002B Perform penetrant testing .....	4844
MEM24003B Perform basic magnetic particle testing .....	4851
MEM24004B Perform magnetic particle testing .....	4858
MEM24005B Perform basic eddy current testing .....	4865
MEM24006B Perform eddy current testing .....	4872
MEM24007B Perform ultrasonic thickness testing .....	4879
MEM24008B Perform ultrasonic testing .....	4886
MEM24009B Perform basic radiographic testing .....	4894
MEM24010B Perform radiographic testing .....	4901
MEM24011B Establish non-destructive tests .....	4909
MEM24012C Apply metallurgy principles .....	4916
MEM25001B Apply fibre-reinforced materials .....	4923
MEM25002B Form and integrate fibre-reinforced structures .....	4929
MEM25003B Set up marine vessel structures .....	4936
MEM25004B Fair and shape surfaces .....	4942

MEM25005B Construct and assemble marine vessel timber components.....	4948
MEM25006B Undertake marine sheathing operations .....	4955
MEM25007B Maintain marine vessel surfaces .....	4962
MEM25008B Repair marine vessel surfaces and structures .....	4968
MEM25009B Form timber shapes using hot processes .....	4975
MEM25010B Perform fitout procedures .....	4981
MEM25011B Install marine systems .....	4988
MEM25012B Install and test operations of marine auxiliary systems.....	4996
MEM25013B Produce three-dimensional plugs/moulds .....	5003
MEM25014B Perform marine slipping operations .....	5010
MEM25015A Assemble and install equipment and accessories/ancillaries .....	5016
MEM26001A Lay up composites using open moulding techniques.....	5023
MEM26002A Lay up composites using vacuum closed moulding techniques.....	5030
MEM26003A Lay up composites using pressure closed moulding techniques.....	5038
MEM26004A Make basic plugs for composites fabrication .....	5045
MEM26005A Make basic moulds for composites fabrication .....	5052
MEM26006A Mark and cut out sheets for composite use .....	5059
MEM26007A Select and use reinforcing appropriate for product.....	5066
MEM26008A Select and use resin systems appropriate for product.....	5073
MEM26009A Select and use cores and fillers appropriate for product.....	5081
MEM26010A Store and handle composite materials .....	5089
MEM26011A Determine materials and techniques for a composite component or product.....	5096
MEM26012A Record and trial work processes for one-off composite products.....	5104
MEM26013A Select and use composite processes or systems appropriate for product.....	5111
MEM26014A Adjust resin chemicals for current conditions .....	5118
MEM26015A Select and apply repair techniques .....	5126
MEM26016A Select and use joining techniques.....	5133
MEM26017A Prepare composite or other substrate surfaces .....	5141
MEM26018A Organise composite trials .....	5147
MEM26019A Finish a composite product.....	5154
MEM26020A Identify and interpret required standards for composites .....	5160
MEM30005A Calculate force systems within simple beam structures .....	5166
MEM30006A Calculate stresses in simple structures.....	5172
MEM30007A Select common engineering materials.....	5178
MEM30008A Apply basic economic and ergonomic concepts to evaluate engineering applications.....	5185
MEM30009A Contribute to the design of basic mechanical systems.....	5191
MEM30010A Set up basic hydraulic circuits.....	5197
MEM30011A Set up basic pneumatic circuits.....	5203
MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment.....	5209
MEM30013A Assist in the preparation of a basic workplace layout.....	5215
MEM30014A Apply basic just in time systems to the reduction of waste.....	5221
MEM30015A Develop recommendations for basic set up time improvements.....	5228
MEM30016A Assist in the analysis of a supply chain .....	5234
MEM30017A Use basic preventative maintenance techniques and tools.....	5239
MEM30018A Undertake basic process planning .....	5245
MEM30019A Use resource planning software systems in manufacturing.....	5251
MEM30020A Develop and manage a plan for a simple manufacturing related project.....	5258
MEM30021A Prepare a simple production schedule .....	5264
MEM30022A Undertake supervised procurement activities.....	5270
MEM30023A Prepare a simple cost estimate for a manufactured product.....	5277
MEM30024A Participate in quality assurance techniques.....	5283

MEM30025A Analyse a simple electrical system circuit.....	5289
MEM30026A Select and test components for simple electronic switching and timing circuits .....	5296
MEM30027A Prepare basic programs for programmable logic controllers.....	5302
MEM30028A Assist in sales of technical products/systems .....	5307
MEM30029A Use workshop equipment and processes to complete an engineering project.....	5313
MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements.....	5322
MEM30032A Produce basic engineering drawings.....	5329
MEM30033A Use computer-aided design (CAD) to create and display 3-D models.....	5335
MEM50001B Classify recreational boating technologies and features .....	5340
MEM50002B Work safely on marine craft .....	5347
MEM50003B Follow work procedures to maintain the marine environment.....	5354
MEM50004B Maintain quality of environment by following marina codes .....	5360
MEM50005B Refuel vessels.....	5366
MEM50006B Check operational capability of marine craft.....	5373
MEM50007B Check operational capability of sails and sail operating equipment.....	5379
MEM50008B Carry out trip preparation and planning .....	5385
MEM50009B Safely operate a mechanically powered recreational boat.....	5392
MEM50010B Respond to boating emergencies and incidents .....	5401
AURVTN2002 Carry out panel repairs .....	5408
BSBADM408A Prepare financial reports .....	5432
BSBCMM401A Make a presentation.....	5441
BSBCMN406A Maintain business technology .....	5448
BSBCRT401A Articulate, present and debate ideas .....	5466
BSBCRT402A Collaborate in a creative process .....	5473
BSBCRT501A Originate and develop concepts .....	5480
BSBCRT601A Research and apply concepts and theories of creativity .....	5489
BSBDES402A Interpret and respond to a design brief .....	5497
BSBDES502A Establish, negotiate and refine a design brief.....	5505
BSBDES601A Manage design realisation .....	5513
BSBDES602A Research global design trends .....	5520
BSBDES701A Research and apply design theory .....	5527
BSBIPR401A Use and respect copyright .....	5534
BSBIPR501A Manage intellectual property to protect and grow business.....	5544
BSBLED705A Plan and implement a mentoring program .....	5554
BSBLED706A Plan and implement a coaching strategy.....	5563
BSBLED710A Develop human capital.....	5573
BSBPMG522A Undertake project work.....	5581
BSBREL701A Develop and cultivate collaborative partnerships and relationships .....	5588
BSBRKG301A Control records .....	5601
BSBSMB403A Market the small business.....	5615
BSBSMB405B Monitor and manage small business operations .....	5622
BSBSMB406A Manage small business finances.....	5628
CPCCLDG3001A Licence to perform dogging .....	5635
CPCCLRG3001A Licence to perform rigging basic level .....	5645
CPCCLSF2001A Licence to erect, alter and dismantle scaffolding basic level.....	5658
CPCCLSF3001A Licence to erect, alter and dismantle scaffolding intermediate level.....	5670
CPCCOHS1001A Work safely in the construction industry .....	5681
CPCPCM4002A Estimate and cost work.....	5692
CPPBDN5013A Develop and collaborate on building information models for small-scale building design projects .....	5700
CUFIND201A Develop and apply creative arts industry knowledge.....	5707

CUFRES401A Conduct research.....	5715
CUVACD304A Make scale models .....	5723
CUVACD504A Research and apply light and colour.....	5732
CUVACD506A Refine 2-D design ideas and processes .....	5738
CUVACD507A Refine 3-D design ideas and processes .....	5746
CUVACD512A Work with photomedia in creative practice .....	5754
CUVACD601A Extend professional expertise with drawing and other visual representation tools.....	5760
CUVDES403A Research and apply techniques for the design of wearable objects .....	5765
CUVDIG401A Experiment with techniques to enhance digital images .....	5773
CUVDIG501A Refine digital art techniques .....	5781
CUVDRA501A Refine drawing techniques.....	5788
CUVDRA502A Investigate drawing materials and processes .....	5795
CUVGRD301A Prepare files for publication.....	5803
CUVJWL401A Experiment with techniques to produce jewellery .....	5810
CUVPHI302A Capture photographic images .....	5819
CUVPHI403A Apply photo imaging lighting techniques .....	5829
CUVPRP403A Select and organise finished work for storage.....	5837
CUVPRP405A Develop and discuss ideas for own creative work.....	5843
CUVPRP501A Realise a body of creative work .....	5848
CUVPRP502A Prepare for sustainable professional practice .....	5857
CUVPRP503A Present a body of own creative work .....	5864
CUVPRP601A Originate a body of independent creative work .....	5871
CUVPRP602A Collaborate in professional creative projects .....	5878
CUVPRP603A Engage in the business of creative practice .....	5885
CUVPRP604A Publicly present a body of own creative work.....	5892
CUVRES502A Analyse cultural history and theory.....	5898
CUVRES601A Extend cultural research expertise .....	5904
FDFOP2005A Work in a socially diverse environment.....	5910
ICTTC136B Install, maintain and modify customer premises communications cabling: ACA Restricted Rule .....	5916
ICTTC137B Install, maintain and modify customer premises communications cabling: ACA Open Rule .....	5926
LMFFDT4012A Produce ideation drawings.....	5940
LMTGN4002A Participate in product engineering.....	5948
MEA101B Interpret occupational health and safety practices in aviation maintenance.....	5954
MEA105C Apply quality standards applicable to aviation maintenance processes.....	5960
MEA107B Interpret and use aviation maintenance industry manuals and specifications.....	5964
MEA108B Complete aviation maintenance industry documentation.....	5969
MEA109B Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance .....	5974
MEA270A Lay out avionic systems.....	5980
MEA271A Lay out avionic flight management systems .....	5985
MEA272B Apply basic scientific principles and techniques in avionic engineering situations.....	5992
MEA273A Select and test avionic engineering materials .....	6000
MEA340A Lay out and set up aircraft systems.....	6008
MEA341A Apply basic aircraft design characteristics.....	6016
MEA342A Apply basic aircraft power plant design characteristics .....	6022
MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations.....	6027
MEA350A Select and test aeronautical engineering materials .....	6034
MEMPE001A Use engineering workshop machines .....	6042



MEMPE002A Use electric welding machines .....	6048
MEMPE003A Use oxy-acetylene and soldering equipment.....	6054
MEMPE004A Use fabrication equipment.....	6060
MEMPE005A Develop a career plan for the engineering and manufacturing industry	6066
MEMPE006A Undertake a basic engineering project.....	6071
MEMPE007A Pull apart and re-assemble engineering mechanisms.....	6079
MSAENV272B Participate in environmentally sustainable work practices .....	6085
MSAENV472B Implement and monitor environmentally sustainable work practices ..	6093
MSAENV672B Develop workplace policy and procedures for environmental sustainability	6102
MSAPCI101A Adapt to work in industry .....	6110
MSAPMSUP106A Work in a team.....	6120
MSATCM304A Interpret basic binary phase diagrams .....	6125
MSATCS301A Interpret architectural and engineering design specifications for structural steel detailing .....	6130
MSATCS302A Detail bolts and welds for structural steelwork connections .....	6137
MSATCS501A Detail standardised structural connections.....	6144
MSATCS502A Detail structural steel members .....	6153
MSATCS503A Incorporate structural steel detailing into fabrication and construction project management .....	6163
MSATCS504A Detail ancillary steelwork.....	6170
MSL976003A Evaluate and select appropriate test methods and/or procedures.....	6178
MSS402002A Sustain process improvements.....	6189
MSS402030A Apply cost factors to work practices.....	6196
MSS402051A Apply quality standards .....	6202
MSS402060A Use planning software systems in operations .....	6211
MSS402061A Use SCADA systems in operations.....	6219
MSS402080A Undertake root cause analysis .....	6226
MSS403001A Implement competitive systems and practices .....	6233
MSS403002A Ensure process improvements are sustained.....	6241
MSS403010A Facilitate change in an organisation implementing competitive systems and practices.....	6249
MSS403021A Facilitate a Just in Time system.....	6258
MSS403023A Monitor a levelled pull system of operations .....	6266
MSS403030A Improve cost factors in work practices .....	6274
MSS403032A Analyse manual handling processes.....	6281
MSS403040A Facilitate and improve implementation of 5S .....	6288
MSS403051A Mistake proof an operational process.....	6297
MSS404050A Undertake process capability improvements .....	6304
MSS404052A Apply statistics to operational processes.....	6311
MSS404060A Facilitate the use of planning software systems in a work area or team ..	6319
MSS404061A Facilitate the use of SCADA systems in a team or work area.....	6326
MSS404081A Undertake proactive maintenance analyses .....	6333
MSS404082A Assist in implementing a proactive maintenance strategy.....	6341
MSS405001A Develop competitive systems and practices for an organisation.....	6349
MSS405002A Analyse and map a value stream .....	6357
MSS405003A Manage a value stream.....	6365
MSS405004A Develop business plans in an organisation implementing competitive systems and practices.....	6372
MSS405005A Manage competitive systems and practices responding to individual and unique customer orders .....	6380
MSS405007A Introduce competitive systems and practices to a small or medium enterprise.....	6389
MSS405010A Manage relationships with non-customer external organisations.....	6397

MSS405011A Manage people relationships .....	6404
MSS405012A Manage workplace learning .....	6411
MSS405020A Develop quick changeover procedures.....	6419
MSS405021A Develop a Just in Time system.....	6427
MSS405022A Design a process layout.....	6436
MSS405023A Develop a levelled pull system for operations and processes .....	6444
MSS405030A Optimise cost of a product or service.....	6452
MSS405031A Undertake value analysis of product or process costs in terms of customer requirements.....	6459
MSS405032A Analyse cost implications of maintenance strategy .....	6466
MSS405040A Manage 5S system in an organisation.....	6474
MSS405050A Determine and improve process capability .....	6482
MSS405052A Design an experiment.....	6489
MSS405060A Develop the application of enterprise control systems in an organisation.....	6498
MSS405061A Determine and establish information collection requirements and processes.....	6506
MSS405070A Develop and manage sustainable energy practices.....	6513
MSS405075A Facilitate the development of a new product.....	6521
MSS405081A Develop a proactive maintenance strategy.....	6530
MSS405083A Adapt a proactive maintenance strategy for a seasonal or cyclical business.....	6538
MSS407001A Prepare for and implement change.....	6547
MSS407002A Review operations practice tools and techniques .....	6556
MSS407003A Analyse process changes.....	6564
MSS407004A Facilitate improvements in the internal value stream .....	6572
MSS407005A Undertake a qualitative review of a process change.....	6581
MSS407006A Build relationships between teams in an operations environment.....	6590
MSS407007A Respond to a major non-conformance .....	6599
MSS407008A Capture learning from daily activities in a organisation.....	6608
MSS407009A Facilitate improvements in the external value stream.....	6616
MSS407010A Improve visual management in the workplace.....	6625
MSS407011A Manage benchmarking studies .....	6633
MSS407012A Lead a problem solving process to determine and solve root cause.....	6640
MSS407013A Review continuous improvement processes .....	6648
MSS408001A Develop the competitive systems and practices approach.....	6656
MSS408002A Audit the use of competitive tools .....	6664
MSS408003A Develop models of future state operations practice.....	6672
MSS408004A Develop the value stream.....	6680
MSS408005A Develop the learning processes of the operations organisation.....	6688
MSS408006A Develop and refine systems for continuous improvement in operations .....	6696
MSS408007A Develop problem solving capability of an organisation.....	6707
MSS408008A Analyse data for relevance to organisational learning .....	6716
PMBPROD291B Operate resin infusion moulding equipment .....	6725
PMBPROD294B Operate resin transfer moulding equipment .....	6732
PMBPROD298B Operate equipment using pre-preg material .....	6739
PMBPROD391B Produce composites using resin infusion .....	6746
PMBPROD394B Produce composites using resin transfer moulding.....	6754
PMBPROD398B Produce composites using pre-pregs.....	6762
PRSTS202A Install security equipment/system .....	6771
PRSTS302A Program security equipment/system .....	6789
PRSTS303A Test installed security equipment/system .....	6805
PRSTS304A Commission/decommission security equipment/system.....	6823
PRSTS305A Identify and diagnose electronic security equipment/ system fault .....	6845
PRSTS307A Maintain and service security equipment/system .....	6865
PRSTS317A Provide estimate and quote .....	6885

<b>PRSTS319A Modify and repair security equipment/system .....</b>	<b>6900</b>
<b>SIRXSL201 Sell products and services .....</b>	<b>6918</b>
<b>TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above).....</b>	<b>6924</b>
<b>TLILIC2001A Licence to operate a forklift truck.....</b>	<b>6936</b>
<b>TLILIC2002A Licence to operate an order picking forklift truck .....</b>	<b>6945</b>
<b>TLILIC3003A Licence to operate a bridge and gantry crane .....</b>	<b>6954</b>
<b>TLILIC3006A Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity) .....</b>	<b>6964</b>
<b>UEPMNT419B Perform civil drafting .....</b>	<b>6976</b>

## Modification History

Version	Release Date	Comments
11.1	5 June 2014	<b>ISC Upgrade</b> <ul style="list-style-type: none"> <li>Data correction to replace missing text in MEM234001A.</li> <li>Correction of typographical error in MEM50212.</li> </ul> Refer to summary mapping for details.
11	16 December 2013	<b>Endorsed changes</b> <p>Addition of one new qualification (MEM20413) and seven new pathways units of competency.</p> <b>ISC Upgrade</b> <p>ISC correction to MEM60112</p> Refer to mapping for details.
10.1	12 September 2013	<b>ISC Upgrade</b> <p>ISC correction of TGA error - Release 2 of MEM07004B, replacing release 1 (refer to version 9 history below)</p> <p>Imported elective units of competency updated to current versions.</p> Refer to mapping for details.
10	26 August 2013	<p>Addition of three new elective units of competency for inclusion in MEM30105.</p> <p>Addition of Skill Set</p> <ul style="list-style-type: none"> <li>MEMSS00001 Non Destructive Testing - Level 2 NDT practitioner</li> </ul> <b>ISC upgrades</b> <ul style="list-style-type: none"> <li>ISC correction to MEM50212</li> <li>ISC code correction in Trade Specialisation Units list to MEM05006C Perform brazing and/or silver soldering (descriptor and range clarified to include braze welding)</li> <li>Change to numbering of Appendices with the reintroduction of MEM05 Units, prerequisites, points and weighting. <ul style="list-style-type: none"> <li>Appendix 1: MEM05 Units, prerequisites, points and weighting.</li> <li>Appendix 2: Trade Specialisation units</li> </ul> </li> </ul>

Version	Release Date	Comments
		<ul style="list-style-type: none"> <li>Appendix 3: Imported units of competency and points and weighting</li> </ul> <p>Refer to summary mapping for details.</p>
9.1	21 March 2013	<p><b>ISC upgrades to MEM20105, MEM20205 and MEM30105</b></p> <p>Inclusion of ISC advice on target groups, assessment requirements and pathways.</p> <p>Other minor corrections to MEM05042B, MEM05043B, MEM05044B, MEM05045B, MEM05046B - Australian Standard code corrected to AS4041.</p>
9	21 December 2012	<p><b>Endorsed changes:</b></p> <ol style="list-style-type: none"> <li>74 new MEM units of competency</li> <li>32 existing MEM units replaced/not carried forward</li> <li>Three updated qualifications with inclusion of additional elective streams: <ul style="list-style-type: none"> <li>MEM50212 Diploma of Engineering – Technical</li> <li>MEM60112 Advanced Diploma of Engineering</li> <li>MEM80112 Vocational Graduate Diploma of Engineering</li> </ul> </li> </ol> <p>Refer to summary mapping for details.</p> <p><b>ISC upgrades:</b></p> <ol style="list-style-type: none"> <li>MSA Competitive Manufacturing elective units replaced with Competitive Systems and Practices units (refer to summary mapping)</li> <li>Additional prerequisite pathway for MEM07004B</li> <li>Five (5) updated qualifications with additional/replaced elective units</li> <li>Three (3) updated qualifications with unit title correction</li> <li>Various typographical errors corrected</li> <li>Appendix 3 re-numbered to 2</li> <li>Appendices removed: <ul style="list-style-type: none"> <li>Appendix 2: MEM05 units, prerequisites, points and weighting (available on the MSA website Training Package information page: <a href="http://www.mskills.com.au/Info.aspx?TAG=MSA.Info.CIP">http://www.mskills.com.au/Info.aspx?TAG=MSA.Info.CIP</a>)</li> <li>Appendix 4: Revised MEM unit codes 2006</li> </ul> </li> </ol>

Version	Release Date	Comments
		<ul style="list-style-type: none"> <li>Appendix 5: MEM05 qualifications mapping to MEM98</li> <li>Appendix 6: Units of competency mapping to MEM98</li> </ul>
8.1	3 September 2012	<b>ISC upgrade</b> Prerequisite correction in MEM3009A - outcomes remain equivalent. Refer to unit for details.
8	29 June 2012	<b>Endorsed changes</b> <ul style="list-style-type: none"> <li>One (1) new qualification – MEM40412 Certificate IV in Engineering Drafting</li> <li>Twenty five (25) new units of competency</li> <li>Four (4) existing MEM units not carried forward</li> </ul> Refer to mapping for details. <p><b>ISC upgrades</b></p> <ul style="list-style-type: none"> <li>Five (5) qualifications updated to include new CAD units of competency: <ul style="list-style-type: none"> <li>MEM30505 Certificate III in Engineering – Technical</li> <li>MEM50211 Diploma of Engineering – Technical</li> <li>MEM50311 Diploma of Jewellery and Object Design</li> <li>MEM60111 Advanced Diploma of Engineering</li> <li>MEM60211 Advanced Diploma of Jewellery and Object Design</li> </ul> </li> <li>Inclusion of additional fourteen (14) imported units</li> <li>Imported unit codes updated (MEA)</li> </ul> Refer to mapping for details.
7	30 March 2012	<b>Addition of:</b> <ul style="list-style-type: none"> <li>One (1) new qualification <ul style="list-style-type: none"> <li>MEM31112 Certificate III in Engineering (Composites Trade)</li> <li>Twenty one (21) new units of competency</li> </ul> </li> </ul> <p><b>ISC upgrades</b></p> <ul style="list-style-type: none"> <li>The new units have also been included as electives in existing MEM qualifications.</li> </ul> Refer to Summary Mapping for details. <p><b>ISC corrections</b></p> Qualification reloaded (corrected for version 6 but not appearing on TGA):

Version	Release Date	Comments
		<ul style="list-style-type: none"> <li>MEM50105 – correction to packaging advice for holders of a Certificate IV</li> <li>Errors corrected re dual band status and formatting made consistent for the following units: MEM05026C, MEM05042B, MEM05043B, MEM05044B, MEM05045B, MEM05046B, MEM05053A, MEM05054A, MEM06009A, MEM07016C, MEM07018C, MEM07019C, MEM07020C, MEM07022C, MEM12003B, MEM12004B, MEM13010A, MEM15022B, MEM17001B, MEM17002B, MEM18010C, MEM18011C, MEM18019B, MEM18021B, MEM18022B, MEM18049C, MEM18050C, MEM18054B, MEM18056B, MEM18062B, MEM18065B, MEM18066B, MEM18067B, MEM18091B, MEM18092B, MEM19018B, MEM20008A, MEM20011A, MEM20012A, MEM20013A, MEM24002B, MEM24004B, MEM24006B, MEM24008B, MEM24010B, MEM24012C</li> </ul>
6	23 December 2011	<p>Addition of:</p> <p>Two (2) new qualifications</p> <ul style="list-style-type: none"> <li>MEM40311 Certificate IV in Advanced Jewellery Manufacture</li> <li>MEM80111 Vocational Graduate Diploma of Engineering</li> </ul> <ul style="list-style-type: none"> <li>Forty six (6) new units of competency</li> <li>Thirty two (32) new imported units of competency.</li> </ul> <p>ISC upgrades:</p> <ul style="list-style-type: none"> <li>Unit codes corrected in Group D in MEM50311</li> <li>Band A and 4 points allocated to MEM19038A for use in Certificate IV</li> </ul> <p>Qualifications:</p> <p>MEM10205 Certificate I in Boating Services</p> <p>The following units missing from the electives have been reinstated:</p> <ul style="list-style-type: none"> <li>MEM50007B</li> <li>MEM50008B</li> <li>MEM50009B</li> <li>MSAENV272B</li> </ul>

Version	Release Date	Comments
		MEM50105 Diploma of Engineering - Advanced Trade
		<ul style="list-style-type: none"> <li>Correction to packaging advice for holders of a Certificate IV</li> </ul>
5	September 2011	<p>Endorsed changes:</p> <p>Two new qualifications:</p> <ul style="list-style-type: none"> <li>MEM50311 Diploma of Jewellery and Object Design</li> <li>MEM60211 Advanced Diploma of Jewellery and Object Design</li> </ul> <p>New and additional units of competency:</p> <ul style="list-style-type: none"> <li>21 new MEM units of competency</li> <li>46 additional imported units of competency</li> </ul> <p>Refer to summary mapping for details.</p> <p>ISC upgrade to one unit of competency:</p> <ul style="list-style-type: none"> <li>MEM05006C Perform brazing and/or silver soldering (descriptor and range clarified to include braze welding)</li> </ul>
4	June 2011	<p>Additional components:</p> <ul style="list-style-type: none"> <li>17 new aeronautical and avionic units of competency and 14 additional units of competency imported from MEA07 for inclusion in the following revised MEM qualifications: <ul style="list-style-type: none"> <li>MEM50211 Diploma of Engineering - Technical</li> <li>MEM60111 Advanced Diploma of Engineering</li> </ul> </li> <li>three new MEM high risk units of competency and nine imported high risk licensing units for inclusion as electives in existing MEM qualifications (refer to mapping for details of packaging and qualifications affected)</li> <li>one new unit of competency for the fuel system installation and service sector, for inclusion as an elective in existing MEM qualifications</li> <li>MEM unit version codes corrected in MEM40105</li> </ul> <p>Refer to Summary Mapping for details of changes to qualifications.</p>
3	March 2011	<p>The following endorsed components have been included in MEM05v3:</p> <ul style="list-style-type: none"> <li>one new qualification – MEM31010 Certificate III in Watch and Clock Service and Repair</li> <li>23 new specialist watch and clock service and repair units of competency.</li> </ul>



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The new units will also be available as electives in MEM20205, MEM40105 and MEM50105, and have been included in the Certificate III Trade Specialisation unit list.

### ISC Updates

- All qualifications adjusted to comply with flexibility and sustainability requirements (refer to Mapping for details).
- Competitive Manufacturing and PMB imported units updated.
- Additional imported units – MSAENV272B, 472B and 672B.
- Minor errors corrected in units and Volume 1 (refer History for details).

2.2	30 June 2010	<b>ISC updates</b> Qualifications adjusted to comply with flexibility rules: MEM10105, MEM20105, MEM20205, MEM50205 and MEM60105. Refer to History for details.
2.1	June 2010	<b>PDF reloaded to NTIS with following corrections:</b> MEM30205 - qualifications notes corrected. No change to packaging rules. Revised unit listed incorrectly as MEM07008D Perform milling operations - changed to MEM07007C Perform milling operations.
2	December 2009	<b>Summary of changes</b> Four new metallurgy units of competency and one new imported unit added to elective bank in MEM40105. ISC upgrades to 18 existing units (affecting MEM20205, 30105, 30205, 30305, 30305, 30405, 30605, 30705, 30805, 50105, 50205, 60105) Expanded descriptors for five qualifications (MEM30205, MEM30305, MEM30405, MEM40105 and MEM50105). Refer to History below for details.
1.02	September 2007	<b>Category 1 changes</b> A range of minor corrections made including typographical errors,

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omissions and clarifications

### **Airconditioning and Refrigeration units of competency**

To meet new licensing requirements for installers of split air conditioning systems and domestic air conditioning and refrigeration systems, one existing unit has been modified and two new units included in the elective banks of MEM05:

#### **Modified unit**

MEM10013A Install split air conditioning systems and associated pipework to include aspects of evacuation, testing and pipework.

This unit replaces and is not equivalent to MEM10012A Install split air conditioning systems. MEM10012A will be discontinued.

#### **New units**

MEM18084A Commission and decommission split air conditioning systems

MEM18085A Install, service and repair domestic air conditioning and refrigeration appliances

The new and modified units are intended to be available for licensing purposes in MEM20105 Certificate II in Engineering. Due to the flexible and open design of the training package, the units are also available as electives in other qualifications such as those listed below. Discretion should be applied when deciding if the units are suitable for selection within a specific qualification.

MEM20105	Certificate II in Engineering
MEM20205	Certificate II in Engineering - Production Technology
MEM30105	Certificate III in Engineering - Production Systems
MEM30205	Certificate III in Engineering - Mechanical Trade
MEM30305	Certificate III in Engineering - Fabrication Trade
MEM30405	Certificate III in Engineering - Electrical/Electronic Trade
MEM30705	Certificate III in Marine Craft Construction

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MEM40105	Certificate IV in Engineering
MEM50105	Diploma of Engineering - Advanced Trade

1.01	October 2006	Decimal points in all MEM05 codes replaced with zero to enable loading to NTIS. Refer to schedule below.
1.00	December 2005	Primary release.

## Version 3

Refer to mapping for details on changes to qualifications and replacement imported units.

### Corrections/Category 1 changes

A range of minor corrections including typographical errors, omissions and clarifications.

Inconsistencies corrected in the units and prerequisites listing in Volume 1.

Points weighting listed incorrectly in three units:

- MEM12007D corrected from 8 to 4 points – points listed in qualifications remains as 4
- MEM20001A corrected from 6 to 4 points – points listed in qualifications remains as 4
- MEM20010A corrected from 2 to 4 points – points listed in qualifications remains as 4.

Prerequisite listed in MEM25008B corrected to MEM25007B (not 25008C).

### Inclusion of metallurgy units in Certificate III Trade Specialisation list

MEM04020A	Supervise individual ferrous melting and casting operation
MEM04021A	Supervise individual non ferrous melting and casting operation
MEM04022A	Examine appropriateness of methoding for mould design
MEM04023A	Undertake prescribed tests on foundry related materials

**Following eight units added to Fabrication Trade stream units in MEM30305**

MEM06001B	Perform hand forging
MEM06002B	Perform hammer forging
MEM06003C	Carry out heat treatment
MEM06004B	Select heat treatment processes and test finished product
MEM06005B	Perform drop and upset forging
MEM06006C	Repair springs
MEM06008A	Hammer forge complex shapes
MEM06009A	Hand forge complex shapes

**Following 12 units added to Electives Group B in MEM60105**

MSACMT280A	Undertake root cause analysis
MSACMT421A	Facilitate a Just in Time (JIT) system
MSACMT430A	Improve cost factors in work practices
MSACMT432A	Analyse manual handling processes
MSACMT440A	Lead 5S in a manufacturing environment
MSACMT450A	Undertake process capability improvements
MSACMT451A	Mistake proof a production process
MSACMT452A	Apply statistics to processes in manufacturing
MSACMT460A	Facilitate the use of planning software systems in manufacturing
MSACMT461A	Facilitate SCADA systems in a manufacturing team or work area
MSACMT481A	Undertake proactive maintenance analyses
MSACMT482A	Assist in implementing a proactive maintenance strategy

### Updated imported units

Competitive Manufacturing unit codes updated from MCM to MSACM.

PMB units updated to B versions.

References to units from relevant qualifications updated to current qualification codes.

(Note: all replacement units are equivalent).

## MEM05v2.2

### Flexibility changes

Importation allowances increased and qualifications reworded to include choice from accredited courses. Elective banks include units approved for selection from other qualifications in MEM.

MEM10105	Certificate I in Engineering	Importation allowance increased from <b>5 to 7 points</b>
MEM20105	Certificate II in Engineering	Importation allowance increased from <b>6 to 8 points</b>
MEM20205	Certificate II in Engineering - Production Technology	Importation allowance increased from <b>11 to 14 points</b>
MEM50205	Diploma of Engineering - Technical	Importation allowance increased from <b>2 to 3 units</b>
MEM60105	Advanced Diploma of Engineering	Importation allowance increased from <b>4 to 5 units</b>

## MEM05v2

New MEM units of competency

MEM04020A	Supervise individual ferrous melting and casting operation
MEM04021A	Supervise individual non ferrous melting and casting operation
MEM04022A	Examine appropriateness of methoding for mould design
MEM04023A	Undertake prescribed tests on foundry related materials

**New imported unit**

MSATCM304A	Interpret binary phase diagrams
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**Revised existing MEM units**

<b>MEM05v1.02</b>	<b>MEM05v2</b>	<b>Unit title</b>	<b>Comment</b>
		<b>Metallurgy</b>	
MEM24012B	MEM24012C	Apply metallurgy principles	Minor edits to include reference to alloys.
		<b>Critical Trade Units</b>	
MEM04005B	MEM04005C	Produce moulds and cores by hand (jobbing)	Redefined and updated Evidence Guides
MEM05010B	MEM05010C	Apply fabrication, forming and shaping techniques	Redefined and updated Evidence Guides
MEM05011C	MEM05011D	Assemble fabricated components	Redefined and updated Evidence Guides
MEM05015C	MEM05015D	Weld using manual metal arc welding process	Redefined and updated Evidence Guides
MEM05017C	MEM05017D	Weld using gas metal arc welding process	Redefined and updated Evidence Guides
MEM05019C	MEM05019D	Weld using gas tungsten arc welding process	Redefined and updated Evidence Guides
MEM05026B	MEM05026C	Apply welding principles	Redefined and updated Evidence Guides
MEM05037B	MEM05037C	Perform geometric development	Redefined and updated Evidence Guides
MEM07005B	MEM07005C	Perform general machining	Redefined and updated Evidence Guides
MEM07006B	MEM07006C	Perform lathe operations	Redefined and updated Evidence Guides

MEM07007B	MEM07007C	Perform milling operations	Redefined and updated Evidence Guides
MEM07008C	MEM07008D	Perform grinding operations	Redefined and updated Evidence Guides
MEM12006B	MEM12006C	Mark off/out (general engineering)	Redefined and updated Evidence Guides
MEM12007C	MEM12007D	Mark off/out structural fabrications and shapes	Redefined and updated Evidence Guides
MEM18006B	MEM18006C	Repair and fit engineering components	Redefined and updated Evidence Guides
		<b>Circuit testing</b>	
MEM18049B	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	Redefined skills and knowledge for circuit testing - equivalent
MEM18050B	MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	Redefined skills and knowledge for circuit testing - equivalent

### Qualifications affected

MEM05v2	Qualification name	Comment
MEM40105	Certificate IV in Engineering	Addition of four metallurgy units to Specialisation Group 1 electives and one imported unit added to Specialisation Group 2 electives.
MEM30205	Certificate III in Engineering -Mechanical	Expanded qualification descriptor
MEM30305	Certificate III in Engineering -Fabrication	Expanded qualification descriptor
MEM30405	Certificate III in Engineering - Electrical/Electronic Trade	Expanded qualification descriptor
MEM40105	Certificate IV in Engineering	Expanded qualification descriptor
MEM50105	Diploma of Engineering -Advanced	Expanded qualification descriptor

	Trade	
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## Preliminary Information

### Important Note to Users

Training Packages are not static documents; they are amended periodically to reflect the latest industry practices and are version controlled. It is essential that the latest version is always used.

### Check the version number before commencing training or assessment

This Training Package is Version 11.1 - check whether this is the latest version by going to [training.gov.au](http://training.gov.au) and locating information about the Training Package. Alternatively, contact Manufacturing Skills Australia (MSA) at <http://www.mskills.com.au> to confirm the latest version number.

### Explanation of version number conventions

The primary release Training Package is Version 1. When changes are made to a Training Package, sometimes the version number is changed and sometimes it is not, depending on the extent of the change. When a Training Package is reviewed it is considered to be a new Training Package for the purposes of version control, and is Version 1. Do not confuse the version number with the Training Packages national code (which remains the same during its period of endorsement).

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## MEM05v11.1 - Mapping of Changes

MEM05 version 11.1 – summary of changes

Component	Release #	Comment
MEM234001A Plan and manage engineering-related projects or operations	2	Replacement of text missing from Element 3 PCs. Equivalent.
MEM50212 Diploma of Engineering – Technical	4	Removal of superseded unit from Group B electives (MEM14082A replaced in V9 by MEM14090A). Equivalent.

## MEM05v11 - Mapping of Changes

### Qualifications

MEM05v10	MEM05v11	Title	Comment
	MEM20413	Certificate II in Engineering Pathways	New qualification - Release 1.

## New MEM units of competency

Unit code	Unit title	Comment
MEMPE001A	Use engineering workshop machines	New unit – Release 1
MEMPE002A	Use electric welding machines	New unit – Release 1
MEMPE003A	Use oxy-acetylene and soldering equipment	New unit – Release 1
MEMPE004A	Use fabrication equipment	New unit – Release 1
MEMPE005A	Develop a career plan for the engineering and manufacturing industry	New unit – Release 1
MEMPE006A	Undertake a basic engineering project	New unit – Release 1
MEMPE007A	Pull apart and re-assemble engineering mechanisms	New unit – Release 1

## ISC Upgrade

MEM60112	Advanced Diploma in Engineering	Release 2 - Code correction in Avionic stream to updated unit MEM23086A
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## MEM05v10.1 - Mapping of Changes

### ISC upgrades

MEM07004B Release 2 reinstated due to TGA transfer error.

Updated imported elective units of competency:

<b>MEM05v10</b>	<b>MEM05v10.1</b>	<b>Qualifications affected</b>	<b>Comment</b>
AURV225908A	AURVTN2002 Carry out panel repairs	MEM30105 MEM40105 MEM50105	No change in outcomes
BSBPMG510A	BSBPMG522A Undertake project work	MEM50311 MEM60211	No change in outcomes
BSBSMB405A	BSBSMB405B Monitor and manage small business operations	MEM40311 MEM50311 MEM60211	No change in outcomes
SIRXSLS001A	SIRXSL201 Sell products and services	MEM50311 MEM60211	No change in outcomes
UEPMNT419A	UEPMNT419B Perform civil drafting	MERM40412 MEM50212	No change in outcomes

## MEM05v10 - Mapping of Changes

### Qualifications

<b>MEM05v9</b>	<b>MEM05v10</b>	<b>Title</b>	<b>Comment</b>
MEM30105	MEM30105	Certificate III in Engineering - Productions Systems	Equivalent - addition of three new electives (available in Groups A and B)
MEM50212	MEM50212	Diploma of Engineering - Technical	ISC correction - MEM09141A and MEM09142A removed from packaging rules (units superseded and replaced in version 9)

### New units of competency

Unit code and title	Points	Prerequisites	Comment
MEM07042A Undertake corrections and basic maintenance to aluminium extrusion dies and die support systems	4	MEM07001B MEM07003B MEM07004B MEM07024B MEM07025B MEM07032B MEM07041A MEM07043A MEM09002B MEM12023A MEM18001C MEM18002B MEM18003C MEM18055B	New units – release 1
MEM07043A Identify causes of faulty aluminium extrusions	6	MEM09002B MEM12023A MEM12024A MEM15002A MEM15024A MEM16006A MEM18001C MEM18002B	
MEM07044A Test a new aluminium extrusion die	4	MEM07043A MEM09002B MEM12023A MEM12024A MEM18001C MEM18002B	

## New Skill Set

MEMSS00001 Non Destructive Testing - Level 2 NDT practitioner

### ISC upgrades

- ISC correction to MEM50212
- ISC code correction in Trade Specialisation Units list to MEM05006C Perform brazing and/or silver soldering (descriptor and range clarified to include braze welding)
- Change to numbering of Appendices with the reintroduction of MEM05 Units, prerequisites, points and weighting.
  - Appendix 1: MEM05 Units, prerequisites, points and weighting.
  - Appendix 2: Trade Specialisation units
  - Appendix 3: Imported units of competency and points and weighting
  -

## MEM05v9 - Mapping of Changes

### Qualifications updated and endorsed in MEM05 version 9

MEM05v8 qualification	MEM05v9 qualification	Comment/ equivalence
MEM50211 Diploma of Engineering – Technical	MEM50212 Diploma of Engineering – Technical	Suite of new elective units added – overall outcomes remain equivalent
MEM60111 Advanced Diploma of Engineering	MEM60112 Advanced Diploma of Engineering	Suite of new elective units added – overall outcomes remain equivalent
MEM80111 Vocational Graduate Diploma of Engineering	MEM80112 Vocational Graduate Diploma of Engineering	Range of new elective units added – overall outcomes remain equivalent

### ISC upgrades to existing qualifications

MEM05v8 qualification	MEM05v9 qualification	Comment/ equivalence
MEM20305	Certificate II in Boating Services	One unit title corrected
MEM30905	Certificate III in Boating Services	One unit title corrected
MEM40205	Certificate IV in Boating	One unit title corrected

MEM05v8 qualification	MEM05v9 qualification	Comment/ equivalence
	Services	
MEM40412 Certificate IV in Engineering Drafting	MEM40412 Certificate IV in Engineering Drafting	MSACM units replaced by competitive systems and practices units Equivalent
MEM20205 Certificate II in Engineering – Production Technology	MEM20205 Certificate II in Engineering – Production Technology	New elective unit added Equivalent
MEM30105 Certificate III in Engineering – Production Systems	MEM30105 Certificate III in Engineering – Production Systems	New elective unit added Equivalent
MEM50311 Diploma of Jewellery and Object Design	MEM50311 Diploma of Jewellery and Object Design	One elective unit replaced Equivalent
MEM60211 Advanced Diploma of Jewellery and Object Design	MEM60211 Advanced Diploma of Jewellery and Object Design	One elective unit replaced Equivalent

### MEM05v9 Mapping of new technician units to MEM05v8

#### Notes

1. This table shows new/revised units for the technician qualifications in the Metal and Engineering Training Package (prerequisites are listed in *italics*)
2. The new units relate to the following engineering disciplines (as indicated in the discipline column):
  - Manufacturing
  - Mechanical
  - Mechatronic
  - Maintenance
  - Heating, ventilation and cooling/refrigeration (HVAC/R)
1. The units are packaged as electives in the MEM qualifications as shown in the packaging column.

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	MEM07041A Perform	New unit	MEM20205	

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	production machining  <i>MEM09002B Interpret technical drawing</i> <i>MEM12023A Perform engineering measurements</i> <i>MEM18001C Use hand tools</i>		MEM30105	
MEM09151A Apply computer aided modelling and data management techniques to mechanical engineering designs	MEM09155A Prepare mechanical models for computer-aided engineering (CAE)  <i>MM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanics principles</i>	Not equivalent	MEM60112 MEM50212	Mechanical Drafting
MEM09152A Apply CAD modelling and data management techniques to mechatronic engineering designs	MEM09156A Prepare mechatronic models for computer-aided engineering (CAE)  <i>MEM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanics principles</i> <i>MEM23111A Select electrical equipment and components for engineering applications</i> <i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i>	Not equivalent	MEM60112 MEM50212	Mechatronic Drafting

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
MEM09141A Represent mechanical engineering designs graphically	MEM09157A Perform mechanical engineering design drafting	Not equivalent	MEM60112 MEM50212	Mechanical Drafting
MEM09142A Represent mechatronic engineering designs graphically	MEM09158A Perform mechatronics engineering design drafting	Not equivalent	MEM60112 MEM50212	Mechatronics Drafting
MEM14061A Plan and design mechanical engineering projects	MEM14085A Apply mechanical engineering analysis techniques  <i>MEM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanic principles</i>	Not equivalent	MEM60112 MEM50212	Mechanical
MEM14062A Plan and design mechatronic engineering projects	MEM14086A Apply mechatronic engineering analysis techniques  <i>MEM23004A Apply technical mathematics</i> <i>MEM23111A Select electrical equipment and components for engineering applications</i> <i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i> <i>MEM14090A Integrate mechatronic fundamentals into an engineering task</i>	Not equivalent	MEM60112 MEM50212	Mechatronic



MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
MEM14063A Plan and design manufacturing engineering projects	<p>MEM14087A Apply manufactured product design techniques</p> <p><i>MEM14089A Integrate mechanical fundamentals into an engineering task</i></p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23063A Select and test mechanical engineering materials</i></p> <p><i>MEM23109A Apply engineering mechanic principles</i></p>	Not equivalent	MEM60112 MEM50212	Manufacturing
MEM14064A Plan and design maintenance engineering projects		<p>Not carried forward</p> <p>Content covered by a range of units</p>		
	<p>MEM14088A Apply maintenance engineering techniques to equipment and component repairs and modifications</p> <p><i>MEM14092A Integrate maintenance fundamentals into an engineering task</i></p> <p><i>MEM23004A Apply technical mathematics</i></p>	New unit	MEM60112 MEM50212	Maintenance
MEM14081A Apply mechanical engineering fundamentals to	MEM14089A Integrate mechanical fundamentals into an engineering task	Not equivalent	MEM60112 MEM50212	Mechanical

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
support design	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23109A Apply engineering mechanics principles</i></p>			
MEM23071A Select and apply mechanical methods, processes and construction techniques		Not carried forward. Content incorporated into MEM14089A Not equivalent	MEM60112 MEM50212	Mechanical
MEM14082A Apply mechatronic engineering fundamentals to support design	<p>MEM14090A Integrate mechatronic fundamentals into an engineering task</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23111A Select electrical equipment and components for engineering applications</i></p> <p><i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i></p>	Not equivalent	MEM60112 MEM50212	Mechatronic
MEM23072A Select and apply mechatronic methods, processes and construction techniques		Not carried forward. Content incorporated into MEM14090A Not equivalent	MEM60112 MEM50212	Mechatronic
	MEM14091A Integrate manufacturing fundamentals into an engineering task	New unit	MEM60112 MEM50212	Manufacturing

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>MEM23004A Apply technical mathematics</i>			
	MEM14092A Integrate maintenance fundamentals into an engineering task  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112 MEM50212	Maintenance
MEM22003A Manage engineering resources	MEM22012A Coordinate resources for an engineering project or operation	Not equivalent	MEM60112 MEM50212	All
MEM22004A Manage engineering projects	MEM22013A Coordinate engineering projects	Not equivalent	MEM60112 MEM50212	All
MEM22005A Manage engineering operations	MEM22014A Coordinate engineering-related manufacturing operations  <i>MEM23004A Apply technical mathematics</i> <i>MEM14091A Integrate manufacturing fundamentals into an engineering task</i>	Not equivalent	MEM60112 MEM50212	All
MEM22006A Source and estimate materials	MEM22015A Source and estimate engineering materials requirements	Not equivalent	MEM60112 MEM50212 MEM50311 MEM60211	All
MEM22008A Manage change and	MEM22017A Coordinate continuous	Not equivalent	MEM60112	All

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
technical development	improvement and technical development		MEM50212	
MEM22009A Manage technical sales and promotion	MEM22018A Coordinate sales and promotion of engineering-related products or services	Not equivalent	MEM60112 MEM50212	All
MEM23001A Apply advanced mathematical techniques in a manufacturing engineering or related environment	MEM23004A Apply technical mathematics	Not equivalent	MEM60112 MEM50212	All
	MEM23005A Apply statistics and probability techniques to engineering tasks  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112	All
	MEM23006A Apply fluid and thermodynamics principles in engineering  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112 MEM50212	Mechanical Maintenance HVAC/R
MEM23002A Apply calculus in engineering situations	MEM23007A Apply calculus to engineering tasks  <i>MEM23004A Apply technical mathematics</i>	Not equivalent	MEM60112 MEM50212	All
	MEM23008A Apply advanced algebra and	New unit	MEM60112	All

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	numerical methods to engineering tasks  <i>MEM23004A Apply technical mathematics</i>			
MEM23061A Select and test mechanical engineering materials	MEM23063A Select and test mechanical engineering materials  <i>MEM23004A Apply technical mathematics</i>  <i>MEM23109A Apply engineering mechanic principles</i>	Not equivalent	MEM80112 MEM60112 MEM50212	Mechanical
MEM23062A Select and test mechatronic engineering materials	MEM23064A Select and test mechatronic engineering materials  <i>MEM23004A Apply technical mathematics</i>  <i>MEM23109A Apply engineering mechanic principles</i>	Not equivalent	MEM80112 MEM60112 MEM50212	Mechatronic
MEM23085A Apply scientific principles and techniques in avionic engineering situations	MEM23086A Apply scientific principles and techniques in avionic engineering situations	Equivalent	MEM60112	
	MEM23109A Apply engineering mechanic principles  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112 MEM50212	Mechanical
MEM23041A		Unit not carried	MEM80112	

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
Apply basic scientific principles and techniques in mechanical engineering situations		forward. Content covered by other units.	MEM60112 MEM50212	
MEM23051A Apply basic electro and control scientific principles and techniques	MEM23111A Select electrical equipment and components for engineering applications  <i>MEM23004A Apply technical mathematics</i>	Not equivalent	MEM80112 MEM60112 MEM50212	Mechatronics
MEM23051A Apply basic electro and control scientific principles and techniques	MEM23112A Investigate electrical and electronic controllers in engineering applications  <i>MEM23004A Apply technical mathematics</i>  <i>MEM23111A Select electrical equipment and components for engineering applications</i>	Not equivalent	MEM80112 MEM60112 MEM50212	Mechatronics
MEM23081A Apply scientific principles and techniques in mechanical engineering situations	MEM23113A Evaluate hydrodynamic systems and system components  <i>MEM23004A Apply technical mathematics</i>  <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i>	Replaced by three units Not equivalent	MEM80112 MEM60112	Mechanical
	MEM23114A Evaluate thermodynamic systems and components			

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>			
	<p>MEM23115A Evaluate fluid power systems</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>			
MEM23082A Apply scientific principles and techniques in mechatronic engineering situations	<p>MEM23116A Evaluate programmable logic controller and related control system component applications</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23111A Select electrical equipment and components for engineering applications</i></p> <p><i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i></p> <p>MEM23117A Evaluate microcontroller applications</p>	<p>Replaced by two units.</p> <p>Not equivalent</p>	MEM80112 MEM60112	Mechatronics

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23111A Select electrical equipment and components for engineering applications</i></p> <p><i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i></p>			
MEM23083A Apply industrial engineering principles and techniques in competitive manufacturing engineering situations	<p>MEM23118A Apply production and service control techniques</p> <p><i>MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment</i></p>	Replaced by two units Not equivalent	MEM80112 MEM60112	Manufacturing
	<p>MEM23119A Evaluate continuous improvement processes</p> <p><i>MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment</i></p> <p><i>MEM23118A Apply production and service control techniques</i></p>			
MEM23091A Apply mechanical system design principles and techniques in mechanical	<p>MEM23120A Select mechanical machine and equipment components</p> <p><i>MEM23004A Apply</i></p>	Replaced by two units Not equivalent	MEM80112 MEM60112	Mechanical



MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
engineering situations	<i>technical mathematics</i> <i>MEM23109A Apply engineering mechanic principles</i>			
	MEM23121A Analyse loads on frames and mechanisms  <i>MEM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanic principles</i> <i>MEM23007A Apply calculus to engineering tasks</i>			
MEM23092A Apply automated systems principles and techniques in engineering situations	MEM23122A Evaluate computer integrated manufacturing systems  <i>MEM23004A Apply technical mathematics</i> <i>MEM23111A Select electrical equipment and components for engineering applications</i> <i>MEM23112A Investigate electrical and electronic controllers in engineering applications</i>	Not equivalent	MEM80112 MEM60112	Mechatronics Manufacturing
MEM23093A Apply plant and process design principles and techniques	MEM23123A Evaluate manufacturing processes	Not equivalent	MEM80112 MEM60112	Manufacturing
MEM23094A Apply maintenance	MEM23124A Measure and analyse noise and	Replaced by two	MEM80112	Mechanical

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
systems principles and techniques	vibration	units	MEM60112	
	<i>MEM23004A Apply technical mathematics</i>	Not equivalent		
	MEM23125A Evaluate maintenance systems			
	<i>MEM23004A Apply technical mathematics</i>			
	<i>MEM14092A Integrate maintenance fundamentals into an engineering task</i>			
	<i>MEM14088A Apply maintenance engineering techniques to equipment and component repairs and modifications</i>			
	MEM23126A Evaluate industrial robotic applications	New unit	MEM60112	Mechanical Manufacturing
	<i>MEM23004A Apply technical mathematics</i>			
	<i>MEM23116A Evaluate programmable logic controller applications</i>			
	<i>MEM23117A Evaluate microcontroller applications</i>			
	<i>MEM23111A Select electrical equipment and components for engineering applications</i>			
	<i>MEM23112A Investigate electrical and electronic</i>			

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>controllers in engineering applications</i>			
	MEM23129A Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i>	New unit	MEM60112	HVAC/R
	MEM23130A Coordinate servicing and fault-finding of HVAC/R control systems  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i>	New unit	MEM60112	HVAC/R
	MEM23131A Evaluate rapid prototyping applications  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112	Manufacturing
	MEM23132A Evaluate rapid manufacturing processes	New unit	MEM60112	Manufacturing

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>MEM23004A Apply technical mathematics</i>			
	MEM23133A Evaluate rapid tooling applications  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112	Mechanical Manufacturing
	MEM23134A Evaluate jigs and fixtures  <i>MEM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanic principles</i>	New unit	MEM60112	Mechanical Manufacturing
	MEM23135A Evaluate moulding tools and processes  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112	Manufacturing
	MEM23136A Evaluate stamping and forging tools  <i>MEM23004A Apply technical mathematics</i> <i>MEM23109A Apply engineering mechanic principles</i>	New unit	MEM60112	Manufacturing Mechanical
	MEM23137A Evaluate rolling tools and processes	New unit	MEM60112	Manufacturing Mechanical

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23109A Apply engineering mechanic principles</i></p>			
	<p>MEM23138A Evaluate suitability of materials for engineering-related applications</p> <p><i>MEM23004A Apply technical mathematics</i></p>	New unit	MEM60112	All
	<p>MEM23139A Design a basic single zone duct distribution system</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p> <p><i>MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements</i></p> <p><i>MEM30033A Use computer-aided design (CAD) to create and display 3-D models</i></p>	New unit	MEM50212	HVAC/R
	<p>MEM23140A Determine operational parameters for building HVAC hydronic systems</p>	New unit	MEM50212	HVAC/R

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>			
	<p>MEM23141A Complete a building thermal performance survey</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p> <p><i>MEM23142A Determine psychrometric processes and system performance</i></p>	New unit	MEM60112	HVAC
	<p>MEM23142A Determine psychrometric processes and system performance</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>	New unit	MEM50212	HVAC/R
	<p>MEM23143A Apply energy management principles</p>	New unit	MEM50212	HVAC/R

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>			
	<p>MEM23144A Contribute to the design of a commercial refrigeration system</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p> <p><i>MEM23129A Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration</i></p>	New unit	MEM60112	HVAC/R
	<p>MEM23145A Apply codes and regulations to air conditioning designs</p> <p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p> <p><i>MEM23140A Determine operational parameters for building HVAC hydronic systems</i></p>	New unit	MEM50212	HVAC/R

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>MEM23142A Determine psychrometric processes and system performance</i>			
	MEM23146A Contribute to the design of industrial refrigeration systems  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i>	New unit	MEM60112	HVAC/R
	MEM23147A Contribute to the design of hydronic systems  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i> <i>MEM23140A Determine operational parameters for building HVAC hydronic systems</i>	New unit	MEM60112	HVAC/R
	MEM23148A Develop energy management solutions  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and</i>	New unit	MEM50212	HVAC/R



MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>thermodynamics principles in engineering</i> <i>MEM23142A Apply psychrometric processes and system performance</i> <i>MEM23143A Apply energy management principles</i> <i>MEM23154A Analyse and service HVAC/R control systems</i>			
	MEM23149A Contribute to the design of commercial and industrial exhaust systems  <i>MEM23004A Apply technical mathematics</i>	New unit	MEM60112	HVAC/R
	MEM23150A Contribute to the design of heating systems  <i>MEM23004A Apply technical mathematics</i> <i>MEM23006A Apply fluid and thermodynamics principles in engineering</i> <i>MEM23140A Determine operational parameters for building HVAC hydronic systems</i> <i>MEM23147A Contribute to the design of hydronic systems</i>	New unit	MEM60112	HVAC

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	MEM23151A Commission and optimise performance of HVAC/R systems  <i>MEM23004A Apply            technical mathematics</i>  <i>MEM23006A Apply            fluid and            thermodynamics            principles in            engineering</i>  <i>MEM23140A Determine            operational parameters            for building HVAC            hydronic systems</i>  <i>MEM23154A Analyse            and service HVAC/R            control systems</i>	New unit	MEM50212	HVAC/R
	MEM23152A Apply principles of refrigeration food storage technology	New unit	MEM50212	HVAC/R
	MEM23153A Contribute to the design of heat exchanger systems  <i>MEM23004A Apply            technical mathematics</i>  <i>MEM23006A Apply            fluid and            thermodynamics            principles in            engineering</i>	New Unit	MEM60112	HVAC/R
	MEM23154A Analyse and service HVAC/R systems	New unit	MEM50212	HVAC/R

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<p><i>MEM23004A Apply technical mathematics</i></p> <p><i>MEM23006A Apply fluid and thermodynamics principles in engineering</i></p>			
	<p>MEM234036A Apply configuration management procedures in engineering project management</p> <p><i>MEM23003A Operate and program computers and/or controllers in engineering situations</i></p> <p><i>MEM234028A Produce and manage technical documentation</i></p> <p><i>MEM234029A Produce and manage technical publications</i></p>	New unit	MEM80112	
	<p>MEM234037A Perform maintenance-related integrated logistic support management activities</p> <p><i>MEM23003A Operate and program computers and/or controllers in engineering situations</i></p> <p><i>MEM234028A Produce and manage technical documentation</i></p> <p><i>MEM234029A Produce and manage technical</i></p>	New unit	MEM80112	

MEM05v8 unit	MEM05v9 unit code	Comment/ equivalence	Packaging	Discipline
	<i>publications</i>			
	MEM234038A Apply systems engineering procedures to engineering design project management	New unit	MEM80112	
	MEM30029A Use workshop equipment and processes to complete an engineering project	New unit	MEM60112	All

### MEM units not carried forward in MEM05v9

MEM09141A Represent mechanical engineering designs graphically
MEM09142A Represent mechatronic engineering designs graphically
MEM09151A Apply computer aided modelling and data management techniques to mechanical engineering designs
MEM09152A Apply CAD modelling and data management techniques to mechatronic engineering designs
MEM14061A Plan and design mechanical engineering projects
MEM14062A Plan and design mechatronic engineering projects
MEM14063A Plan and design manufacturing engineering projects
MEM14064A Plan and design maintenance engineering projects
MEM14081A Apply mechanical engineering fundamentals to support design and development of projects
MEM14082A Apply mechatronic engineering fundamentals to support design and development of projects
MEM22003A Manage engineering resources
MEM22004A Manage engineering projects

MEM22005A Manage engineering operations
MEM22006A Source and estimate materials
MEM22008A Manage change and technical development
MEM22009A Manage technical sales and promotion
MEM23001A Apply advanced mathematical techniques in a manufacturing, engineering or related environment
MEM23002A Apply calculus in engineering situations
MEM23041A Apply basic scientific principles and techniques in mechanical engineering situations
MEM23051A Apply basic electro and control scientific principles and techniques
MEM23061A Select and test mechanical engineering materials
MEM23062A Select and test mechatronic engineering materials
MEM23071A Select and apply mechanical methods, processes and construction techniques
MEM23072A Select and apply mechatronic methods, processes and construction techniques
MEM23081A Apply scientific principles and techniques in mechanical engineering situations
MEM23082A Apply scientific principles and techniques in mechatronic engineering situations
MEM23083A Apply industrial engineering principles and techniques in competitive manufacturing engineering situations
MEM23085A Apply scientific principles and techniques in avionic engineering situations
MEM23091A Apply mechanical system design principles and techniques in mechanical engineering situations
MEM23092A Apply automated systems principles and techniques in engineering situations
MEM23093A Apply plant and process design principles and techniques in engineering situations
MEM23094A Apply maintenance systems principles and techniques in engineering situations

## MEM05v8 - Mapping of Changes

### Changes to qualifications

<b>MEM05v7 Code</b>	<b>MEM05v8 Code</b>	<b>Title</b>	<b>Comment</b>
	MEM40412	Certificate IV in Engineering Drafting	New qualification
MEM30505	MEM30505	Certificate III in Engineering – Technical	Additional and replacement electives – equivalent
MEM50211	MEM50211	Diploma of Engineering – Technical	Additional and replacement electives - equivalent
MEM50311	MEM50311	Diploma of Jewellery and Object Design	Replacement of one elective unit - equivalent
MEM60111	MEM60111	Advanced Diploma of Engineering	Additional and replacement electives - equivalent
MEM60211	MEM60211	Advanced Diploma of Jewellery and Object Design	Replacement of one elective unit - equivalent

### Qualifications – packaging of new electives

<b>Unit</b>	<b>MEM30505 Certificate III in Engineering - Technical</b>	<b>MEM40412 Certificate IV in Engineering Drafting</b>	<b>MEM50211 Diploma of Engineering - Technical</b>	<b>MEM50311 Diploma of Jewellery and Object Design</b>	<b>MEM60111 Advanced Diploma of Engineering</b>	<b>MEM60211 Advanced Diploma of Jewellery and Object Design</b>
MEM09201A Work effectively in an engineering drafting workplace	X	X				
MEM09202A	X	X	X			

Unit	MEM3050 5 Certificate III in Engineering - Technical	MEM4041 2 Certificate IV in Engineering Drafting	MEM5021 1 Diploma of Engineering - Technical	MEM5031 1 Diploma of Jewellery and Object Design	MEM6011 1 Advanced Diploma of Engineering	MEM6021 1 Advanced Diploma of Jewellery and Object Design
Produce freehand sketches						
MEM09203A Measure and sketch site information	X	X	X			
MEM09204A Produce basic engineering detail drawings		X	X		X	
MEM09205A Produce electrical schematic drawings	X	X	X		X	
MEM09206A Produce drawings for mechanical services		X	X			
MEM09207A Produce drawings for reticulated services		X	X			
MEM09208A Detail fasteners and locking devices in mechanical	X	X	X			

Unit	MEM30505 Certificate III in Engineering - Technical	MEM40412 Certificate IV in Engineering Drafting	MEM50211 Diploma of Engineering - Technical	MEM50311 Diploma of Jewellery and Object Design	MEM60111 Advanced Diploma of Engineering	MEM60211 Advanced Diploma of Jewellery and Object Design
drawings						
MEM09209A Detail bearings, seals and other componentry in mechanical drawings	X	X	X			
MEM09210A Create 3-D solid models using computer-aided design (CAD) system		X	X			
MEM09211A Produce drawings or models for industrial piping		X	X			
MEM09212A Produce detailed drawings of steel to non-steel connections		X	X			
MEM09213A Produce schematic drawings for hydraulic and pneumatic	X	X	X			



Unit	MEM3050 5 Certificate III in Engineering - Technical	MEM4041 2 Certificate IV in Engineering Drafting	MEM5021 1 Diploma of Engineering - Technical	MEM5031 1 Diploma of Jewellery and Object Design	MEM6011 1 Advanced Diploma of Engineering	MEM6021 1 Advanced Diploma of Jewellery and Object Design
fluid power systems						
MEM09214A Perform advanced engineering detail drafting			X			
MEM09215A Manage detail drafting projects			X			
MEM09216A Interpret and produce curved 3-D shapes and patterns		X	X			
MEM09217A Prepare plans for pipe and duct fabrication		X	X			
MEM09218A Participate in drafting projects for building services		X	X			
MEM09219A Prepare drawings for fabricated sheet metal		X	X			

Unit	MEM30505 Certificate III in Engineering - Technical	MEM40412 Certificate IV in Engineering Drafting	MEM50211 Diploma of Engineering - Technical	MEM50311 Diploma of Jewellery and Object Design	MEM60111 Advanced Diploma of Engineering	MEM60211 Advanced Diploma of Jewellery and Object Design
products						
MEM09220A Apply surface modelling techniques to 3-D drawings		X	X			
MEM09221A Create 3-D model assemblies using computer-aided design (CAD) system		X	X			
MEM09222A Interpret and maintain or restore original drawings			X			
MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements	X	X	X	X	X	X
MEM30032A Produce basic engineering drawings	X	X	X		X	

Unit	MEM30505 Certificate III in Engineering - Technical	MEM40412 Certificate IV in Engineering Drafting	MEM50211 Diploma of Engineering - Technical	MEM50311 Diploma of Jewellery and Object Design	MEM60111 Advanced Diploma of Engineering	MEM60211 Advanced Diploma of Jewellery and Object Design
MEM30033A Use computer-aided design (CAD) to create and display 3-D models	X	X	X		X	

### Mapping of new CAD units to previous CAD units

**Note:** These changes only apply to the following qualifications:

- MEM30505 Certificate III in Engineering – Technical
- MEM50211 Diploma of Engineering – Technical
- MEM50311 Diploma of Jewellery and Object Design
- MEM60111 Advanced Diploma of Engineering
- MEM60211 Advanced Diploma of Jewellery and Object Design

Existing units remain packaged in the following qualifications:

- MEM30705 Certificate III in Marine Craft Construction
- MEM40105 Certificate IV in Engineering
- MEM50105 Diploma of Engineering – Advanced Trade

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
MEM09201A Work effectively in an engineering drafting workplace		New unit. Covers skills related to working in drafting and understanding the role of drafting across industries and in various applications.
MEM09202A Produce freehand sketches		New unit. Covers freehand sketching skills and standard drawing conventions and techniques.

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
MEM09203A Measure and sketch site information		New unit. Covers skills to take onsite measurements, perform calculations and sketch site information to inform drafting work.
MEM09204A Produce basic engineering detail drawings <u>Prerequisite:</u> MEM09002B Interpret technical drawing	MEM09003B Prepare basic engineering drawing	Not equivalent. This unit is aimed at general detail drafting across all sectors and forms the base level detail drafting skill upon which further drafting specialisation or advanced drafting skills are developed. Covers preparation of detail 2-D drawings to AS 1100.
MEM09205A Produce electrical schematic drawings <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09204A Produce basic engineering detail drawings	MEM09004B Perform electrical/electronic detail drafting	Not equivalent. This unit targets specialist electrical detail drafting skills.  Unit more comprehensively details electrical/electronic schematic drawing skills than MEM09004B.
MEM09206A Produce drawings for mechanical services <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09204A Produce basic engineering detail drawings		New unit. Covers specialised detail drafting skills for mechanical services.
MEM09207A Produce drawings for reticulated services		New unit. Covers specialised detail drafting skills for reticulated services. Unit also covers selecting pipe and duct fabrication

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
<u>Prerequisites:</u> MEM09205A Produce basic engineering detail drawings MEM09002B Interpret technical drawing		methods
MEM09208A Detail fasteners and locking devices in mechanical drawings <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09205A Produce basic engineering detail drawings		New unit. Covers specialised detail drafting skills.
MEM09209A Detail bearings, seals and other componentry in mechanical drawings <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09204A Produce basic engineering detail drawings		New unit. Covers specialised detail drafting skills.
MEM09210A Create 3-D solid models using computer-aided design (CAD) system <u>Prerequisites:</u> MEM09002B	MEM09010C Create 3-D solid models using computer-aided design (CAD) system	Not equivalent. The new unit extends and updates 3-D modelling skills.

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
Interpret technical drawing MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements		
MEM09211A Produce drawings or models for industrial piping <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09204A Produce basic engineering detail drawings		New unit. Covers specialised detail drafting skills.
MEM09212A Produce detailed drawings of steel to non-steel connections <u>Prerequisites:</u> MEM09002B Interpret technical drawing MEM09204A Produce basic engineering detail drawings		New unit. Covers specialised detail drafting skills.
MEM09213A Produce schematic drawings for hydraulic and pneumatic fluid power systems <u>Prerequisites:</u>		New unit. Covers specialised detail drafting skills.

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
<p>MEM09002B Interpret technical drawing engineering detail drawings</p> <p>MEM09204A Produce basic engineering detail drawings</p>		
<p>MEM09214A Perform advanced engineering detail drafting</p> <p><u>Prerequisites:</u></p> <p>MEM09002B Interpret technical drawing</p> <p>MEM09204A Produce basic engineering detail drawings</p> <p>MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment</p>		<p>New unit. Covers advanced detail drafting skills including tolerancing and dimensioning. Also includes extended skills in the use of CAD systems.</p> <p>Based on, extends and replaces MEM09006A and MEM09007B. Not equivalent.</p>
<p>MEM09215A Supervise detail drafting projects</p> <p><u>Prerequisites:</u></p> <p>MEM09002B Interpret technical drawing</p> <p>MEM09204A Produce basic engineering detail drawings</p> <p>MEM09214A Perform advanced</p>		<p>New unit. Covers management of drafting projects.</p>

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
<p>engineering detail drafting</p> <p>MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment</p> <p>MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements</p>		
MEM09216A Interpret and produce curved 3-D shapes and patterns	MEM09021B Interpret and produce curved 3-dimensional shapes	New unit, based on MEM09021B. Not equivalent – content extended and updated.
<p>MEM09217A Prepare plans for pipe and duct fabrication</p> <p><u>Prerequisite:</u></p> <p>MEM09002B Interpret technical drawing</p>		New unit.
<p>MEM09218A Participate in drafting projects for building services</p> <p><u>Prerequisites:</u></p> <p>MEM09002B Interpret technical drawing</p> <p>MEM09204A Produce basic engineering detail drawings</p>		New unit.
MEM09219A Prepare drawings for		New unit.



<b>MEM05v8 - NEW UNITS</b>	<b>MEM05 PREVIOUS UNITS</b>	<b>COMMENTS</b>
<p>fabricated sheet metal products</p> <p><u>Prerequisite:</u></p> <p>MEM09002B Interpret technical drawing</p>		
<p>MEM09220A Apply surface modelling techniques to 3-D drawings</p> <p><u>Prerequisites:</u></p> <p>MEM09002B Interpret technical drawing</p> <p>MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements</p>		New unit.
<p>MEM09221A Create 3-D model assemblies using computer-aided design (CAD) system</p> <p><u>Prerequisites:</u></p> <p>MEM09002B Interpret technical drawing</p> <p>MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements</p>		New unit.
<p>MEM09222A Interpret and maintain or restore original drawings</p>		New unit.

MEM05v8 - NEW UNITS	MEM05 PREVIOUS UNITS	COMMENTS
<u>Prerequisite:</u> MEM30032A Produce basic engineering drawings		
MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements	MEM30001A Use computer aided drafting systems to produce basic engineering drawings	Based on MEM30001A but not equivalent. This unit covers introductory CAD operations skills, with an emphasis on CAD operations required for producing detail drawings. It forms the starting base for CAD drafting skills and does not require completion of a detail drawing to AS1100. Completion of a basic detail drawing to AS1100 is covered in new unit MEM30032A Produce basic engineering drawings. Also includes computer coverage from MEM16008A.
MEM30032A Produce basic engineering drawings		New unit, based on a merger of MEM30002A and MEM30003A. Not equivalent.
MEM30033A Use computer-aided design (CAD) to create and display 3-D models <u>Prerequisite:</u> MEM30031A Operate CAD system to produce basic drawing elements	MEM30004A Use computer-aided design (CAD) to create and display 3-D models	New unit, based on MEM30004A but not equivalent. Covers introductory 3-D modelling skills.

### Existing MEM units not carried forward

MEM30001A Use computer aided drafting systems to produce basic engineering drawings	Replaced by MEM30031A
MEM30002A Produce basic engineering graphics	Not carried forward. Content

	covered in MEM30032A.
MEM30003A Produce detailed engineering drawings	Not carried forward. Content covered in MEM30032A.
MEM30004A Use CAD to create and display 3D models	Replaced by MEM30033A.

### Additional imported units of competency

Unit code	Unit title
CPCCOHS1001A	Work safely in the construction industry
CPCPCM4002A	Estimate and cost work
CPPBDN5013A	Develop and collaborate on building information models for small-scale building design projects
FDFOP2005A	Work in a socially diverse environment
LMTGN4002A	Participate in product engineering
MSACMS201A	Sustain process improvements
MSACMT251A	Apply quality standards
MSATCS301A	Interpret architectural and design specifications for structural steel detailing
MSATCS302A	Detail bolts and welds for structural steelwork connections
MSATCS501A	Detail standardised structural connections
MSATCS502A	Detail structural steel members
MSATCS503A	Incorporate structural steel detailing into fabrication and construction project management
MSATCS504A	Detail ancillary steelwork
UEPMNT419A	Perform Civil Drafting

### Imported units of competency - version changes

MEA105B Apply quality standards	Replaced by MEA105C Apply quality standards
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applicable to aviation maintenance processes	applicable to aviation maintenance processes - equivalent
MEA272A Apply basic scientific principles and techniques in avionic engineering situations	Replaced by MEA272B Apply basic scientific principles and techniques in avionic engineering situations - equivalent
MEA349A Apply basic scientific principles and techniques in aeronautical engineering situations	Replaced by MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations - equivalent

## MEM05v7 - Mapping of Changes

### Changes to qualifications

MEM05v6 Code	MEM05v7 Code	Title	Comment
MEM20105	MEM20105	Certificate II in Engineering	One additional elective - equivalent
MEM20205	MEM20205	Certificate II in Engineering – Production Technical	One additional elective - equivalent
MEM30105	MEM30105	Certificate III in Engineering – Production Systems	Additional electives – equivalent
MEM30205	MEM30205	Certificate III in Engineering – Mechanical Trade	Additional electives added to trade specialisation list – equivalent
MEM30305	MEM30305	Certificate III in Engineering – Fabrication Trade	Additional electives added to trade specialisation list – equivalent
	MEM31112	Certificate III in Engineering (Composites Trade)	New qualification
MEM50105	MEM50105	Diploma in Engineering – Advanced Trade	Typographic error corrected in advice re minimum requirements for holders of other MEM qualifications.

**New Units of competency**

Unit code	Unit title	Quals affected
<i>Composites</i>		
MEM26001 A	Lay up composites using open moulding techniques	MEM30105, 30205 & 30305
MEM26002 A	Lay up composites using vacuum closed moulding techniques	As above
MEM26003 A	Lay up composites using pressure closed moulding techniques	As above
MEM26004 A	Make basic plugs for composites fabrication	As above
MEM26005 A	Make basic moulds for composites fabrication	As above
MEM26006 A	Mark and cut out sheets for composite use	As above
MEM26007 A	Select and use reinforcing appropriate for product	As above, plus MEM20105
MEM26008 A	Select and use resin systems appropriate for product	As above, plus MEM20105
MEM26009 A	Select and use cores and fillers appropriate for product	As above, plus MEM20105
MEM26010 A	Store and handle composite materials	MEM30105, 30205 & 30305
MEM26011 A	Determine materials and techniques for a composite component or product*	As above
MEM26012 A	Record and trial work processes for one-off composite products	As above
MEM26013 A	Select and use composite processes or systems appropriate for product	As above
MEM26014	Adjust resin chemicals for current conditions	As above

## New Units of competency

Unit code	Unit title	Quals affected
<b><i>Composites</i></b>		
MEM26001 A	Lay up composites using open moulding techniques	MEM30105, 30205 & 30305
A		
MEM26015 A	Select and apply repair techniques	As above
MEM26016 A	Select and use joining techniques	As above
MEM26017 A	Prepare composite or other substrate surfaces	As above
MEM26018 A	Organise composite trials	As above
MEM26019 A	Finish a composite product	As above
MEM26020 A	Identify and interpret required standards for composites	As above
<b><i>Aluminothermic welding</i></b>		
MEM05027 A	Perform aluminothermic welding	MEM20105, 20205, 30105, 30205, 30305

## MEM05v6 - Mapping of Changes

### New qualifications

Code	Title	Comment
MEM40311	Certificate IV in Advanced Jewellery Manufacture	New qualification
MEM80111	Advanced Graduate Diploma of Engineering	New qualification

### New Units of competency

Unit code	Unit title	Prerequisites
MEM19044A	Repair and restore antique jewellery	
MEM19045A	Set gems in channel style settings	
MEM19046A	Apply grain setting techniques	
MEM19047A	Set gems in claw and bezel style settings	
MEM19048A	Develop and apply complex borders and decorations for hand engraving	
MEM19049A	Develop and apply heraldic designs for hand engraving	
MEM19050A	Hand carve engraving work	
MEM19051A	Construct multiple stone settings	MEM19047A MEM19045A
MEM19052A	Produce complex objects using silversmithing techniques	MEM19033A
MEM19053A	Create complex findings and mechanisms for jewellery items	
MEM19054A	Fabricate platinum jewellery items	
MEM234001A	Plan and manage engineering-related projects or operations	
MEM234002A	Integrate engineering technologies	
MEM234003A	Design machines and ancillary equipment	

MEM234004A	Design for engineering-related noise and vibration mitigation	
MEM234005A	Design hydrodynamic pumping systems	
MEM234006A	Evaluate and select thermodynamic systems or sub-systems	
MEM234007A	Design fluid power systems	
MEM234008A	Design plant using computer simulations	
MEM234009A	Design computer-integrated manufacturing systems	
MEM234010A	Design microcontroller applications	
MEM234011A	Design programmable logic controller applications	
MEM234012A	Design integrated maintenance management systems	
MEM234013A	Plan and design engineering-related manufacturing processes	
MEM234014A	Design a robotic system	
MEM234015A	Design hydronic heat exchanger systems	
MEM234016A	Design refrigeration systems	
MEM234017A	Design exhaust, ventilation and dust collection systems	
MEM234018A	Design heating, ventilation, air conditioning and refrigeration control systems	
MEM234019A	Apply finite element analysis in engineering design	
MEM234020A	Coordinate small lot manufacture using rapid manufacture processes	
MEM234021A	Apply statistics to technology problems	
MEM234022A	Apply advanced calculus to technology problems	



MEM234023A	Apply differential equations to technology problems	
MEM234024A	Apply advanced mathematics in technology problems	
MEM234025A	Apply numerical methods to technology problems	
MEM234026A	Develop and coordinate engineering-related contingency plans	
MEM234027A	Plan and manage materials supply for an engineering project or manufacturing operation	
MEM234028A	Produce and manage technical documentation	
MEM234029A	Produce and manage technical publications	
MEM234030A	Provide specialised technical and engineering guidance to other technical employees	
MEM234031A	Manage installation, commissioning or modification of machines and equipment	
MEM234032A	Manage fluid power related technologies in an enterprise	
MEM234033A	Lead engineering-related quality operations in an enterprise	
MEM234034A	Manage heating, ventilation, air conditioning and refrigeration systems or projects	
MEM234035A	Maintain and apply technical and engineering skills	

### New imported units

Unit code	Unit title	Prerequisites
BSBLED705A	Plan and implement a mentoring program	

BSBLED706A	Plan and implement a coaching strategy	
BSBLED710A	Develop human capital	
BSBREL701A	Develop and cultivate collaborative partnerships and relationships	
MSACMG700A	Review continuous improvement processes	
MSACMG701A	Prepare for and implement change	
MSACMG702A	Review manufacturing practice tools and techniques	
MSACMG703A	Analyse process changes	
MSACMG704A	Facilitate improvements in the internal value chain	
MSACMG705A	Undertake a qualitative review of a process change	
MSACMG706A	Build relationships between teams in a manufacturing environment	
MSACMG707A	Respond to a major non-conformance	
MSACMG708A	Capture learning from daily activities in a manufacturing organisation	
MSACMG709A	Facilitate improvements in the external value chain	
MSACMG710A	Improve visual management in the workplace	
MSACMG711A	Manage benchmarking studies	
MSACMG712A	Lead a problem solving process to determine and solve root cause	
MSACMG800A	Analyse data for relevance to organisational learning	
MSACMG801A	Develop the competitive manufacturing approach	
MSACMG802A	Audit the use of competitive tools	
MSACMG803A	Develop models of future state manufacturing practice	

MSACMG804A	Develop the value chain	
MSACMG805A	Develop the learning processes of the manufacturing organisation	
MSACMG806A	Develop and refine systems for continuous improvement in manufacturing organisations	
MSACMG807A	Develop problem solving capability of a manufacturing organisation	
MSACMS606A	Introduce competitive manufacturing to a small or medium enterprise	
MSACMT620A	Develop quick changeover procedures	
MSACMT622A	Design a process layout	
MSACMT623A	Develop a levelled pull system of manufacturing	
MSACMT632A	Analyse cost implications of maintenance strategy	
MSAENV672B	Develop workplace policy and procedures for sustainability	
MSL976003A	Evaluate and select appropriate test methods and procedures	

## MEM05v5 - Mapping of Changes

### New qualifications

Code	Title	Comment
MEM50311	Diploma of Jewellery and Object Design	New qualification
MEM60211	Advanced Diploma of Jewellery and Object Design	New qualification

Units of competency (MEM50311 and MEM60211)

**P** = prerequisites

**E** = existing MEM unit

**N** = new MEM unit

**NI** = new imported unit (\*where marked with an asterisk, unit to be endorsed in CUV11)

**EI** = existing imported unit

<b>MEM05v5</b>		<b>MEM05v4</b>		<b>Relationship to previous version</b>
MEM05006C	Perform brazing and/or silver soldering	MEM05006B	Perform brazing and/or silver soldering	Corrections to descriptor and range to clarify inclusion of 'brazing welding' - equivalent

<b>Unit code</b>	<b>Unit title</b>	<b>P</b>	<b>Status</b>	<b>Diploma</b>	<b>Advanced Diploma</b>
MEM05006C	Perform brazing and/or silver soldering		E	Y	Y
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing		E	Y	Y
MEM08010B	Manually finish/polish materials	MEM18001C	E	Y	Y
MEM09002B	Interpret technical drawing		E	Y	Y
MEM12023A	Perform engineering measurements		E	Y	Y
MEM12024A	Perform computations		E	Y	Y
MEM13003B	Work safely with industrial chemicals and materials		E	Y	Y
MEM13004B	Work safely with molten metals/glass		E	Y	Y
MEM13014A	Apply principles of occupational health and safety in the work environment		E	Y	Y
MEM16006A	Organise and communicate information		E	Y	Y
MEM16008A	Interact with computing		E	Y	Y

	technology				
MEM18001C	Use hand tools		E	Y	Y
MEM18002B	Use power tools/hand held operations		E	Y	Y
MEM18003C	Use tools for precision work	MEM12023A MEM18001C MEM18002B	E	Y	Y
MEM19001B	Perform jewellery metal casting	MEM13004B	E	Y	Y
MEM19012B	Produce jewellery wax model	MEM18001C MEM18002B MEM18003C	E	Y	Y
MEM19013B	Produce jewellery metal masters	MEM08010B MEM13004A MEM16006A MEM19001B	E	Y	Y
MEM19023A	Apply drawing and rendering techniques to jewellery or object design		N	Y	Y
MEM19024A	Use CAD to create and display 3D jewellery and object models		N	Y	Y
MEM19025A	Create and present designs for jewellery and other 3D objects		N	Y	Y
MEM19026A	Investigate quality and application of jewellery materials		N	Y	Y
MEM19027A	Produce life drawings for presenting jewellery and object designs	MEM19023A	N	Y	Y
MEM19028A	Select materials and new technologies for jewellery and 3D object design		N	Y	Y

	applications				
MEM19029A	Produce a professional jewellery design and 3D object portfolio		N	Y	Y
MEM19030A	Research and design sustainable objects		N	Y	Y
MEM19031A	Produce renderings and technical drawings for jewellery and object design construction		N	Y	Y
MEM19032A	Design and implement mechanisms in jewellery items		N	Y	Y
MEM19033A	Create silversmithing objects		N	Y	Y
MEM19034A	Apply chain manufacture process		N	Y	Y
MEM19035A	Plan and apply casting techniques for jewellery and object designs		N	Y	Y
MEM19036A	Use specialised techniques to produce jewellery and objects		N	Y	Y
MEM19037A	Plan and implement chenier fabrication process		N	Y	Y
MEM19038A	Apply traditional techniques to jewellery and 3D object production		N		Y
MEM19039A	Plan, conduct and supervise a jewellery and object exhibition		N		Y
MEM19040A	Create and manufacture jewellery or object design prototypes for the mass market		N		Y
MEM19041A	Experiment with jewellery		N		Y

	or object designs				
MEM19042A	Render images using computer graphics software	MEM19024A	N	Y	Y
MEM19043A	Oversee jewellery or object design production		N		Y
MEM22006A	Source and estimate materials		E	Y	Y
MEM30001A	Use computer aided drafting systems to produce basic engineering drawings	MEM16006A MEM16008A	E	Y	Y
<b>Imported units</b>					
BSBCMM401A	Make a presentation		NI	Y	Y
BSBCRT401A	Articulate, present and debate ideas		NI	Y	Y
BSBCRT402A	Collaborate in a creative process		NI	Y	Y
BSBCRT501A	Originate and develop concepts		NI	Y	Y
BSBCRT601A	Research and apply concepts and theories of creativity		NI		Y
BSBDES402A	Interpret and respond to a design brief		NI	Y	Y
BSBDES502A	Establish, negotiate and refine a design brief		NI	Y	Y
BSBDES601A	Manage design realisation		NI		Y
BSBDES602A	Research global design trends		NI		Y
BSBDES701A	Research and apply design theory		NI		Y

BSBIPR401A	Use and respect copyright		NI	Y	Y
BSBIPR501A	Manage intellectual property to protect and grow business		NI	Y	Y
BSBPMG510A	Manage projects		NI	Y	Y
BSBSMB403A	Market the small business		NI	Y	Y
BSBSMB405A	Monitor and manage small business operations		NI	Y	Y
BSBSMB406A	Manage small business finances		NI	Y	Y
CUFIND201A	Develop and apply creative arts industry knowledge		NI	Y	Y
CUFRES401A	Conduct research		NI	Y	Y
CUVACD304A	Make scale models		*NI	Y	Y
CUVACD504A	Research and apply light and colour		*NI	Y	Y
CUVACD506A	Refine 2-D design ideas and processes		*NI	Y	Y
CUVACD507A	Refine 3-D design ideas and processes		*NI	Y	Y
CUVACD512A	Work with photomedia in creative practice		*NI	Y	Y
CUVACD601A	Extend professional expertise with drawing and other visual representation tools		*NI		Y
CUVDES403A	Research and apply techniques for the design of wearable objects		*NI	Y	Y
CUVDIG401A	Experiment with techniques to enhance digital images		*NI	Y	Y
CUVDIG501A	Refine digital art techniques		*NI	Y	Y
CUVDRA501A	Refine drawing techniques		*NI	Y	Y



CUVDRA502A	Investigate drawing materials and processes		*NI	Y	Y
CUVGRD301A	Prepare files for publication		*NI	Y	Y
CUVJWL401A	Experiment with techniques to produce jewellery		*NI	Y	Y
CUVPHI302A	Capture photographic images		*NI	Y	Y
CUVPHI403A	Apply photo imaging lighting techniques		*NI	Y	Y
CUVPRP403A	Select and organise finished work for storage		*NI	Y	Y
CUVPRP405A	Develop and discuss ideas for own creative work		*NI	Y	Y
CUVPRP501A	Realise a body of creative work		*NI	Y	Y
CUVPRP502A	Prepare for sustainable professional practice		*NI	Y	Y
CUVPRP503A	Present a body of own creative work		*NI	Y	Y
CUVPRP601A	Originate a body of independent creative work		*NI		Y
CUVPRP602A	Collaborate in professional creative projects		*NI		Y
CUVPRP603A	Engage in the business of creative practice		*NI		Y
CUVPRP604A	Publicly present a body of own creative work		*NI		Y
CUVRES502A	Analyse cultural history and theory		*NI	Y	Y
CUVRES601A	Extend cultural research expertise		*NI		Y
LMFFDT4012A	Produce ideation drawings		NI	Y	Y

MSAENV272B	Participate in environmentally sustainable work practices		EI	Y	Y
MSAENV472B	Implement and monitor environmentally sustainable work practices		EI	Y	Y
SIRXSLS001A	Sell products and services		NI	Y	Y

## MEM05v4 - Mapping of Changes

### Qualifications mapping

### Revised qualifications

MEM05v3		MEM05v4		Comment
MEM50205	Diploma of Engineering - Technical	MEM50211	Diploma of Engineering - Technical	Addition of new stream - RTOs will be required to extend scope if they wish to deliver the new aeronautical and avionic units of competency. All other outcomes remain equivalent.
MEM60105	Advanced Diploma of Engineering	MEM60111	Advanced Diploma of Engineering	Addition of new stream - RTOs will be required to extend scope if they wish to deliver the new aeronautical and avionic units of competency. All other outcomes remain equivalent.

### Allocation of new electives to existing qualifications

Code	Title	Change - units added to the elective choice
MEM20205	Certificate II in Engineering - Production Technology	MEM11023A Operate a bridge and gantry crane MEM11024A Undertake basic rigging MEM11025A Operate a non-slewing mobile crane of greater than three tones capacity MEM18098A Prepare to perform work associated with fuel system installation and servicing

		<p>TLILIC2001A Licence to operate a forklift truck</p> <p>TLILIC2002A Licence to operate an order picking forklift truck</p> <p>TLILIC3003A Licence to operate a bridge and gantry crane</p> <p>TLILIC3006A Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)</p> <p>TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)</p> <p>CPCCLDG3001A Licence to perform dogging</p> <p>CPCCLRG3001A Licence to perform rigging basic level</p> <p>CPCCLSF2001A Licence to erect, alter and dismantle scaffolding basic</p> <p>CPCCLSF3001A Licence to erect, alter and dismantle scaffolding intermediate</p>
MEM20305	Certificate II in Boating Services	<p>TLILIC2001A Licence to operate a forklift truck</p> <p>TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)</p>
MEM30105	Certificate III in Engineering - Production Systems	<p>MEM11023A Operate a bridge and gantry crane</p> <p>MEM11024A Undertake basic rigging</p> <p>MEM11025A Operate a non-slewing mobile crane of greater than three tones capacity</p> <p>MEM18098A Prepare to perform work associated with fuel system installation and servicing</p> <p>TLILIC2001A Licence to operate a forklift truck</p> <p>TLILIC2002A Licence to operate an order picking forklift truck</p> <p>TLILIC3003A Licence to operate a bridge and gantry crane</p> <p>TLILIC3006A Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)</p> <p>TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)</p> <p>CPCCLDG3001A Licence to perform dogging</p> <p>CPCCLRG3001A Licence to perform rigging basic level</p> <p>CPCCLSF2001A Licence to erect, alter and dismantle scaffolding basic level</p> <p>CPCCLSF3001A Licence to erect, alter and dismantle scaffolding intermediate level</p>
MEM30205	Certificate III in	MEM18098A Prepare to perform work associated with

	Engineering - Mechanical Trade	fuel system installation and servicing
MEM30305	Certificate III in Engineering - Fabrication Trade	MEM18098A Prepare to perform work associated with fuel system installation and servicing
MEM30405	Certificate III in Engineering - Electrical Trade	MEM18098A Prepare to perform work associated with fuel system installation and servicing
MEM30905	Certificate III in Boating Services	TLILIC2001A Licence to operate a forklift truck TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)
MEM40105	Certificate IV in Engineering	MEM18098A Prepare to perform work associated with fuel system installation and servicing TLILIC2001A Licence to operate a forklift truck TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)
MEM50105	Diploma of Engineering - Advanced Trade	MEM18098A Prepare to perform work associated with fuel system installation and servicing TLILIC2001A Licence to operate a forklift truck TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)
		<p>The following units have also been added to the Certificate III Trade Specialisation Units list for use if required in the qualifications listed below:</p> <p>TLILIC2001A Licence to operate a forklift truck TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above).</p> <ul style="list-style-type: none"> <li>▶ MEM30205 Certificate III in Engineering – Mechanical Trade</li> <li>▶ MEM30305 Certificate III in Engineering – Fabrication Trade</li> <li>▶ MEM30405 Certificate III in Engineering – Electrical/Electronic Trade</li> <li>▶ MEM30605 Certificate III in Jewellery Manufacture</li> <li>▶ MEM30705 Certificate III in Marine Craft Construction</li> <li>▶ MEM30805 Certificate III in Locksmithing</li> </ul>

## Packaging of High Risk Licensing Units

High risk licensing unit	Points	Packaging information
TLILIC2001A Licence to operate a forklift truck	0	<p>This unit has been allocated no points and imported as an elective to:</p> <ul style="list-style-type: none"> <li>▸ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▸ MEM20305 Certificate II in Boating Services</li> <li>▸ MEM30905 Certificate III in Boating Services</li> <li>▸ MEM30105 Certificate III in Engineering – Production Systems</li> <li>▸ MM40105 Certificate IV in Engineering</li> <li>▸ MEM50105 Diploma of Engineering – Advanced Trade</li> </ul> <p>The unit is also included in the list of Certificate III trade specialisation units.</p>
TLILIC2002A Licence to operate an order picking forklift truck	0	<p>This unit has been allocated no points and imported as an elective to:</p> <ul style="list-style-type: none"> <li>▸ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▸ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
TLILIC3003A Licence to operate a bridge and gantry crane	0	<p>A new MEM unit has been developed and allocated 4 points to provide MEM required work outcomes for use in conjunction with the licensing unit – MEM11023A Operate a bridge and gantry crane.</p> <p>TLILIC3003A has been imported and allocated no points. MEM11023A and TLILIC3003A have been included as electives in:</p> <ul style="list-style-type: none"> <li>▸ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▸ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1	<p>Unit has been allocated 1 point and imported as an elective to the following qualifications:</p> <ul style="list-style-type: none"> <li>▸ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▸ MEM20305 Certificate II in Boating Services</li> <li>▸ MEM30905 Certificate III in Boating Services</li> <li>▸ MEM30105 Certificate III in Engineering – Production Systems</li> <li>▸ MEM40105 Certificate IV in Engineering</li> <li>▸ MEM50105 Diploma of Engineering – Advanced</li> </ul>

		<p>Trade</p> <p>The unit has also been included in the list of Certificate III trade specialisation units.</p>
CPCCLDG3001A - Licence to perform dogging	0	<p>This unit has been allocated no points and imported as an elective to:</p> <ul style="list-style-type: none"> <li>▶ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▶ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
CPCCLRG3001A - Licence to perform rigging basic level	0	<p>A new MEM unit has been developed and allocated 4 points to provide MEM required work outcomes for use in conjunction with the licensing unit – MEM11024A Undertake basic rigging.</p> <p>CPCCLRG3001A has been imported and allocated no points. MEM11024A and CPCCLRG3001A have been included as electives in:</p> <ul style="list-style-type: none"> <li>▶ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▶ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
CPCCLSF2001A - Licence to erect, alter and dismantle scaffolding basic level	0	<p>This unit has been allocated no points and imported as an elective to:</p> <ul style="list-style-type: none"> <li>▶ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▶ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
CPCCLSF3001A - Licence to erect, alter and dismantle scaffolding intermediate level	0	<p>This unit has been allocated no points and imported as an elective to:</p> <ul style="list-style-type: none"> <li>▶ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▶ MEM30105 Certificate III in Engineering – Production Systems</li> </ul>
TLILIC3006A Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)	0	<p>A new MEM unit has been developed and allocated 4 points to provide MEM required work outcomes for use in conjunction with the licensing unit – MEM11025A Operate a non-slewing mobile crane of greater than 3 tonnes capacity.</p> <p>TLILIC3006A has been imported and allocated no points. MEM11025A and TLILIC3006A have been included as electives in:</p> <ul style="list-style-type: none"> <li>▶ MEM20205 Certificate II in Engineering – Production Technology</li> <li>▶ MEM30105 Certificate III in Engineering –</li> </ul>

		Production Systems
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## MEM05v4 - New units and additional imported units of competency

<b>High risk rigging</b>	
MEM11023A	Operate a bridge and gantry crane
MEM11024A	Undertake basic rigging
MEM11025A	Operate a non-slewing mobile crane of greater than three tonnes capacity
<b>Fuel system installation and service</b>	
MEM18098A	Prepare to perform work associated with fuel system installation and servicing
<b>Aerospace</b>	
MEM09143A	Represent aeronautical engineering designs
MEM09144A	Represent avionic engineering designs
MEM09153A	Apply computer-aided modelling and data management techniques to aeronautical engineering designs
MEM09154A	Apply computer-aided modelling and data management techniques to avionic engineering designs
MEM14065A	Plan and design aeronautical engineering projects
MEM14066A	Plan and design avionic engineering projects
MEM14083A	Apply aeronautical engineering fundamentals to support design and development of engineering projects
MEM14084A	Apply avionic engineering fundamentals to support design and development of engineering projects
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques
MEM23084A	Apply scientific principles and techniques in aeronautical engineering

	situations
MEM23085A	Apply scientific principles and techniques in avionic engineering situations
MEM23095A	Apply aeronautical system design principles and techniques in aeronautical engineering situations
MEM23096A	Apply avionic system design principles and techniques in avionic engineering situations
MEM23097A	Apply automated systems principles and techniques in aeronautical engineering situations
MEM23098A	Apply automated systems principles and techniques in avionic engineering situations
<b>Imported units</b>	
	<b>MEA units</b>
MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA105B	Apply quality standards applicable to aviation maintenance processes
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA108B	Complete aviation maintenance industry documentation
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance
MEA270A	Lay out avionic systems
MEA271A	Lay out avionic flight management systems
MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
MEA273A	Select and test avionic engineering materials
MEA340A	Lay out and set up aircraft systems
MEA341A	Apply basic aircraft design characteristics
MEA342A	Apply basic aircraft power plant design characteristics
MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
MEA350A	Select and test aeronautical engineering materials
	<b>High Risk Licensing</b>
CPCCLDG3001A	Licence to perform dogging
CPCCLRG3001A	Licence to perform rigging basic level
CPCCLSF2001A	Licence to erect, alter and dismantle scaffolding basic level
CPCCLSF3001A	Licence to erect, alter and dismantle scaffolding intermediate level



TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)
TLILIC2001A	Licence to operate a forklift truck
TLILIC2002A	Licence to operate an order picking forklift truck
TLILIC3003A	Licence to operate a bridge and gantry crane
TLILIC3006A	Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)

## MEM05v3 - Mapping of Changes

### Qualifications – summary of changes

Note:

- All qualifications have been adjusted to include sustainability units of competency and to comply with the 1/3 elective and 1/6 importation requirements.
- MSAENV sustainability units added to core and/or electives – all qualifications.  
MSAENV472B has been included in the Certificate III Trade Specialisation list of units.
- Points allocated to MSAENV units: MSAENV272B = 3, MSAENV472B = 4.
- For points based qualifications, where MSAENV272B has been added to core units, the total elective points required have been reduced by three to accommodate inclusion of the extra unit in the core. Similarly, other qualifications have had the elective choice reduced by one unit. Note that all MEM qualifications already exceeded the requirement that at least 1/3 of the total must be electives.
- **Total points to achieve a qualification have been based on points required in industrial instruments and have not been altered.\***
- All qualification outcomes remain equivalent.

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
MEM10105	Certificate I in Engineering	MSAENV 272B (electives)	24 pts	24 pts	24 pts	8 pts	4 pts	<b>Import allowance reverts to 5 points as in MEM05v</b>

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
								2 (incorrectly changed to 7 points June 2010, based on wrong points calculations).
MEM10205	Certificate I in Boating Services	MSAENV 272B (electives)	3 units	3 units	10 units	3 units	2 units	Imports increased from nil to 2 units.
MEM20105	Certificate II in Engineering	MSAENV 272B (electives)	30 pts	30 pts	32 pts	11 pts	5 pts	<b>Import allowance reverts to 6 points</b> as in MEM05v2 (incorrectly changed to 8 points June 2010, based on wrong points calculations)

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
MEM20205	Certificate II in Engineering – Production Technology	MSAENV 272B (core)	53 pts	50 pts	64 pts	21 pts	11 pts	Sustainability unit added to core and elective points adjusted. <b>Import allowance reverts to 11 points</b> (incorrectly changed to 14 points June 2010, based on wrong points calculations)
MEM20305	Certificate II in Boating Services	MSAENV 272B (electives)	6 units	6 units	14 units	5 units	2 units	Import allowance increased from one to two to meet 1/6 rule
MEM30105	Certificate III in Engineering – Production Systems	MSAENV 272B (core) MSAENV 472B (specialisation)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainability unit added to core. Total elective points

Code	Title	MSAENV unit/s	MEM0 5v2 elective points/ units require d	MEM0 5v3 elective points/ units require d	*To tal poin ts or unit s	1/3 elective require ment	1/6 import require ment	Comm en ts
		electives)						adjusted to 73.  Import allowance increased from 15 to 16 to meet 1/6 rule.
MEM3 0205	Certificate III in Engineering – Mechanical Trade	MSAENV 272B (core)  MSAENV 472B (specialisa tion electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainab ility unit added to core. Total elective points adjusted to 73.  Import allowance increased from 15 to 16 to meet 1/6 rule.
MEM3 0305	Certificate III in Engineering – Fabrication Trade	MSAENV 272B (core)  MSAENV 472B (specialisa tion electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainab ility unit added to core. Total elective points adjusted to 73.  Import allowance increased

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
								from 15 to 16 to meet 1/6 rule.  Eight MEM 06 series units added to fabrication trade stream.
MEM3 0405	Certificate III in Engineering – Electrical/Electronic Trade	MSAENV 272B (core) MSAENV 472B (specialisation electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainability unit added to core. Total elective points adjusted to 73.  Import allowance increased from 15 to 16 to meet 1/6 rule.
MEM3 0505	Certificate III in Engineering – Technical	MSAENV 272B (core)	8 units	7 units	10 units	3 units	2 units	Sustainability unit added to core. Elective choice reduced to 7 units. Import allowance

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
								increased from nil to two units to meet 1/6 rule.
MEM3 0605	Certificate III in Jewellery Manufacture	MSAENV 272B (core) MSAENV 472B (specialisation electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainability unit added to core. Total elective points adjusted to 73. Import allowance increased from 15 to 16 to meet 1/6 rule.
MEM3 0705	Certificate III in Marine Craft Construction	MSAENV 272B (core) MSAENV 472B (specialisation electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainability unit added to core. Total elective points adjusted to 73. Import allowance increased from 15 to 16 to meet 1/6 rule.

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
								rule.
MEM30805	Certificate III in Locksmithing	MSAENV 272B (core) MSAENV 472B (specialisation electives)	76 pts	73 pts	96 pts	32 pts	16 pts	Sustainability unit added to core. Total elective points adjusted to 73.  Import allowance increased from 15 to 16 to meet 1/6 rule.
MEM30905	Certificate III in Boating Services	MSAENV 272B (core)	14 units	13 units	21 units	7 units	4 units	Sustainability unit added to core. Elective choice reduced to 13 units. Import allowance increased from 3 to 4 units to meet 1/6 rule.
MEM31010	Certificate III in Watch and Clock Service and Repair	MSAENV 272B (core) MSAENV	n/a	73 pts	96 pts	32 pts	16 pts	New qualification. Includes

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
		472B (specialisation electives)						sustainability units and meets 1/3 and 1/6 requirements.
MEM4 0105	Certificate IV in Engineering	MSAENV 272B (core) MSAENV 472B (specialisation electives)	112 pts	109 pts	132 pts	44 pts	22 pts	Sustainability unit added to core. Total elective points adjusted to 109. No change to import allowance.
MEM4 0205	Certificate IV in Boating Services	MSAENV 272B (core) MSAENV 472B (electives)	20 units	19 units	29 units	10 units	5 units	Sustainability unit added to core. Elective choice reduced to 19 units. Import allowance increased from 4 to 5 units to meet 1/6 rule.



Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
MEM50105	Diploma of Engineering – Advanced Trade	MSAENV 272B (core) MSAENV 472B (electives)	120 pts*	117 pts	156 pts	52 pts	26 pts	Sustainability unit added to core. Elective choice adjusted to 117. Import allowance increased from 24 to 26 to meet 1/6 requirement.  <i>*Note: error in MEM05v2 packaging rules corrected from 136 to 120 points.</i>
MEM50205	Diploma of Engineering – Technical	MSAENV 272B (core) MSAENV 472B (electives)	16 units	15 units	20 units	7 units	3 units	Sustainability unit added to core. Elective choice reduced to 15 units. Import allowance = 3 units

Code	Title	MSAENV unit/s	MEM05v2 elective points/units required	MEM05v3 elective points/units required	*Total points or units	1/3 elective requirement	1/6 import requirement	Comments
								(no change from MEM05v 2.2 version, June 2010)
MEM60105	Advanced Diploma of Engineering	MSAENV 272B (core) MSAENV 472B and 672B (electives)	24 units	23 units	30 units	10 units	5 units	Sustainability unit added to core. Elective choice reduced to 23.  Import allowance = 5 units (no change from MEM05v 2.2 version, June 2010).  Addition of 12 Competitive Manufacturing units to Elective Group B.

**MEM05v3 - new units**

Unit code	Unit title	Points
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange	2
MEM21003A	Perform watch case servicing, repair and refurbishment	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches	2
MEM21006A	Service quartz watches	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21010A	Service watch power generating systems	2
MEM21011A	Service calendar and other dial indication mechanisms for watches	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21013A	Service, test and adjust watch escapements	4
MEM21014A	Service mechanical chronograph watches	6
MEM21015A	Perform precision watch timing and adjustment	6
MEM21016A	Install and set up clocks	2
MEM21017A	Service and repair clock timepieces	6
MEM21018A	Service clock escapements and oscillating systems	4
MEM21019A	Service and repair clock striking mechanisms	4
MEM21020A	Service and repair clock chiming mechanisms	6
MEM21021A	Restore clockwork mechanisms	6
MEM21022A	Manufacture watch and clock components	6

MEM21023A	Plan, set up and operate horological workshop or service centre	4
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### MEM05v2 Qualifications mapping V1.02 to V2

MEM05v1.02	MEM05v2	Qualification name	Comment
MEM40105	MEM40105	Certificate IV in Engineering	Addition of four metallurgy units to Specialisation Group 1 electives and one imported unit added to Specialisation Group 2 electives.
MEM30205	MEM30205	Certificate III in Engineering-Mechanical	Expanded qualification descriptor - equivalent
MEM30305	MEM30305	Certificate III in Engineering-Fabrication	Expanded qualification descriptor - equivalent
MEM30405	MEM30405	Certificate III in Engineering-Electrical/Electronic Trade	Expanded qualification descriptor - equivalent
MEM40105	MEM40105	Certificate IV in Engineering	Expanded qualification descriptor - equivalent
MEM50105	MEM50105	Diploma of Engineering-Advanced Trade	Expanded qualification descriptor - equivalent

### MEM05 Qualifications mapping V1.01 to V1.02

Following is a summary list of qualification codes for the MEM05 V1.02 Metal and Engineering Training Package. Qualifications have been mapped to show their relationship to the previous version MEM05 V1.01

V1.02	V1.01	Nature of relationship	Change to qualification outcome
MEM10105	MEM10105	Equivalent qualification	No change

MEM10205	MEM10205	Equivalent qualification	No change
MEM20105	MEM20105	Equivalent qualification	No change
MEM20205	MEM20205	Equivalent qualification	No change
MEM20305	MEM20305	Equivalent qualification	No change
MEM30105	MEM30105	Equivalent qualification	No change
MEM30205	MEM30205	Equivalent qualification	No change
MEM30305	MEM30305	Equivalent qualification	No change
MEM30405	MEM30405	Equivalent qualification	No change
MEM30505	MEM30505	Equivalent qualification	No change
MEM30605	MEM30605	Equivalent qualification	No change
MEM30705	MEM30705	Equivalent qualification	No change
MEM30805	MEM30805	Equivalent qualification	No change
MEM30905	MEM30905	Equivalent qualification	No change
MEM40105	MEM40105	Equivalent qualification	No change
MEM40205	MEM40205	Equivalent qualification	No change
MEM50105	MEM50105	Equivalent qualification	No change
MEM50205	MEM50205	Equivalent qualification	No change
MEM60105	MEM60105	Equivalent qualification	No change

### Unit mapping MEM05 V2 to V1.02

The letter 'Y' in the prerequisite column (labeled P) of the mapping table below indicates that a unit of competency has one or more prerequisites. Refer to Appendix 1 for details of pre-requisite units.

MEM05v1.02	MEM05v2	Unit title	P	Comment
		Metallurgy		

	MEM04020A	Supervise individual ferrous melting and casting operation	Y	New unit
	MEM04021A	Supervise individual non ferrous melting and casting operation	Y	New unit
	MEM04022A	Examine appropriateness of methoding for mould design	Y	New unit
	MEM04023A	Undertake prescribed tests on foundry related materials	Y	New unit
MEM24012B	MEM24012C	Apply metallurgy principles		Minor edits to include reference to alloys. Equivalent.
		<b>Critical trade</b>		
MEM04005B	MEM04005C	Produce moulds and cores by hand (jobbing)	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05010B	MEM05010C	Apply fabrication, forming and shaping techniques	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05011C	MEM05011D	Assemble fabricated components	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05015C	MEM05015D	Weld using manual metal arc welding process	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05017C	MEM05017D	Weld using gas metal arc welding process	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05019C	MEM05019D	Weld using gas tungsten arc welding process	Y	Redefined and updated Evidence Guides. Equivalent.
MEM05026B	MEM05026C	Apply welding principles		Redefined and updated Evidence Guides. Equivalent.
MEM05037B	MEM05037C	Perform geometric development	Y	Redefined and updated Evidence

				Guides. Equivalent.
MEM07005B	MEM07005C	Perform general machining	Y	Redefined and updated Evidence Guides. Equivalent.
MEM07006B	MEM07006C	Perform lathe operations	Y	Redefined and updated Evidence Guides. Equivalent.
MEM07007B	MEM07007C	Perform milling operations	Y	Redefined and updated Evidence Guides. Equivalent.
MEM07008C	MEM07008D	Perform grinding operations	Y	Redefined and updated Evidence Guides. Equivalent.
MEM12006B	MEM12006C	Mark off/out (general engineering)	Y	Redefined and updated Evidence Guides. Equivalent.
MEM12007C	MEM12007D	Mark off/out structural fabrications and shapes	Y	Redefined and updated Evidence Guides. Equivalent.
MEM18006B	MEM18006C	Repair and fit engineering components	Y	Redefined and updated Evidence Guides. Equivalent.
		Circuit testing		
MEM18049B	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	Y	Redefined skills and knowledge for circuit testing – equivalent
MEM18050B	MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	Y	Redefined skills and knowledge for circuit testing – equivalent

### Unit mapping MEM05 V1.01 to V1.02

The letter ‘Y’ in the prerequisite column (labeled P) of the mapping table below indicates that a unit of competency has one or more prerequisites. Refer to Appendix 1 for details of pre-requisite units.

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM03001B	Perform manual production assembly		No change. Equivalent unit
MEM03002B	Perform precision assembly	Y	No change. Equivalent unit
MEM03003B	Perform sheet and plate assembly	Y	Corrected title of MEM05003B in pre req pathway. Cat 1 change. Unit equivalent.
MEM03004B	Perform electronic/electrical assembly (production)		No change. Equivalent unit
MEM03005B	Rework and repair (electrical/electronic production)	Y	No change. Equivalent unit
MEM03006B	Set assembly stations	Y	No change. Equivalent unit
MEM04001B	Operate melting furnaces	Y	No change. Equivalent unit
MEM04002B	Perform gravity die casting	Y	No change. Equivalent unit
MEM04003B	Operate pressure die casting machine	Y	No change. Equivalent unit
MEM04004B	Prepare and mix sand for metal moulding		No change. Equivalent unit
MEM04005B	Produce moulds and cores by hand (jobbing)	Y	No change. Equivalent unit
MEM04006B	Operate sand moulding and core making machines		No change. Equivalent unit
MEM04007B	Pour molten metal	Y	No change. Equivalent unit
MEM04008B	Fettle and trim metal castings/forgings	Y	No change. Equivalent unit
MEM04010B	Develop and manufacture wood patterns	Y	No change. Equivalent unit



<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM04011B	Produce polymer patterns	Y	No change. Equivalent unit
MEM04012B	Assemble plated patterns	Y	No change. Equivalent unit
MEM04013B	Develop and manufacture polystyrene patterns	Y	No change. Equivalent unit
MEM04014B	Develop and manufacture production patterns	Y	No change. Equivalent unit
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	Y	No change. Equivalent unit
MEM04016C	Develop and manufacture precision models	Y	No change. Equivalent unit
MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	Y	No change. Equivalent unit
MEM04018B	Perform general woodworking machine operations	Y	No change. Equivalent unit
MEM04019B	Perform refractory installation and repair	Y	No change. Equivalent unit
MEM05001B	Perform manual soldering/desoldering – electrical/electronic components		No change. Equivalent unit
MEM05002B	Perform high reliability soldering and desoldering	Y	No change. Equivalent unit
MEM05003B	Perform soft soldering		No change. Equivalent unit
MEM05004C	Perform routine oxy acetylene welding		No change. Equivalent unit
MEM05005B	Carry out mechanical cutting	Y	No change. Equivalent unit
MEM05006B	Perform brazing and/or silver soldering		No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM05007C	Perform manual heating and thermal cutting		Correction to unit title Correction to PC numbering Cat 1 change. Cat 1 change. Unit equivalent.
MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	Y	No change. Equivalent unit
MEM05009C	Perform automated thermal cutting	Y	No change. Equivalent unit
MEM05010B	Apply fabrication, forming and shaping techniques	Y	No change. Equivalent unit
MEM05011C	Assemble fabricated components	Y	No change. Equivalent unit
MEM05012C	Perform routine manual metal arc welding		No change. Equivalent unit
MEM05013C	Perform manual production welding		No change. Equivalent unit
MEM05014C	Monitor quality of production welding/fabrications	Y	No change. Equivalent unit
MEM05015C	Weld using manual metal arc welding process	Y	No change. Equivalent unit
MEM05016C	Perform advanced welding using manual metal arc welding process	Y	No change. Equivalent unit
MEM05017C	Weld using gas metal arc welding process	Y	No change. Equivalent unit
MEM05018C	Perform advanced welding using gas metal arc welding process	Y	Application and range statement clarified. Cat 1 change. Unit equivalent.
MEM05019C	Weld using gas tungsten arc welding process	Y	No change. Equivalent unit
MEM05020C	Perform advanced welding using gas tungsten arc welding process	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM05022C	Perform advanced welding using oxy acetylene welding process	Y	No change. Equivalent unit
MEM05023C	Weld using submerged arc welding process	Y	Deleted incorrect references in knowledge list. Cat 1 change. Unit equivalent.
MEM05024B	Perform welding supervision	Y	No change. Equivalent unit
MEM05025C	Perform welding/fabrication inspection	Y	No change. Equivalent unit
MEM05026B	Apply welding principles		No change. Equivalent unit
MEM05036C	Repair/replace/modify fabrications	Y	No change. Equivalent unit
MEM05037B	Perform geometric development	Y	No change. Equivalent unit
MEM05038B	Perform advanced geometric development - cylindrical/rectangular	Y	Application statement clarified. Cat 1 change. Unit equivalent.
MEM05039B	Perform advanced geometric development - conical	Y	Application statement clarified. Cat 1 change. Unit equivalent.
MEM05040B	Perform advanced geometric development - transitions	Y	Application statement clarified. Cat 1 change. Unit equivalent.
MEM05041B	Weld using powder flame spraying	Y	
MEM05042B	Perform welds to code standards using flux core arc welding process	Y	Corrected missing pre-requisite. Cat 1 change. Unit equivalent.
MEM05043B	Perform welds to code standards using gas metal arc welding process	Y	No change. Equivalent unit
MEM05044B	Perform welds to code standards using gas tungsten arc welding process	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM05045B	Perform pipe welds to code standards using manual metal arc welding process	Y	No change. Equivalent unit
MEM05046B	Perform welds to code standards using manual metal arc welding process	Y	No change. Equivalent unit
MEM05047B	Weld using flux core arc welding process	Y	Corrected missing pre-requisite. Cat 1 change. Unit equivalent.
MEM05048B	Perform advanced welding using flux core arc welding process	Y	Corrected missing pre-requisite. Cat 1 change. Unit equivalent.
MEM05049B	Perform routine gas tungsten arc welding		No change. Equivalent unit
MEM05050B	Perform routine gas metal arc welding		No change. Equivalent unit
MEM05051A	Select welding processes		No change. Equivalent unit
MEM05052A	Apply safe welding practices		No change. Equivalent unit
MEM05053A	Set and edit computer controlled thermal cutting machines	Y	No change. Equivalent unit
MEM05054A	Write basic NC/CNC programs for thermal cutting machines	Y	No change. Equivalent unit
MEM06001B	Perform hand forging	Y	No change. Equivalent unit
MEM06002B	Perform hammer forging		No change. Equivalent unit
MEM06003C	Carry out heat treatment		No change. Equivalent unit
MEM06004B	Select heat treatment processes and test finished product	Y	No change. Equivalent unit
MEM06005B	Perform drop and upset forging	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM06006C	Repair springs	Y	No change. Equivalent unit
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing		No change. Equivalent unit
MEM06008A	Hammer forge complex shapes	Y	No change. Equivalent unit
MEM06009A	Hand forge complex shapes	Y	No change. Equivalent unit
MEM07001B	Perform operational maintenance of machines/equipment	Y	No change. Equivalent unit
MEM07002B	Perform precision shaping/planing/slotting operations	Y	No change. Equivalent unit
MEM07003B	Perform machine setting (routine)	Y	No change. Equivalent unit
MEM07004B	Perform machine setting (complex)	Y	No change. Equivalent unit
MEM07005B	Perform general machining	Y	Application statement clarified. Cat 1 change. Unit equivalent.
MEM07006B	Perform lathe operations	Y	No change. Equivalent unit
MEM07007B	Perform milling operations	Y	No change. Equivalent unit
MEM07008C	Perform grinding operations	Y	No change. Equivalent unit
MEM07009B	Perform precision jig boring operations	Y	No change. Equivalent unit
MEM07010B	Perform tool and cutter grinding operations	Y	No change. Equivalent unit
MEM07011B	Perform complex milling operations	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM07012B	Perform complex grinding operations	Y	No change. Equivalent unit
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	Y	No change. Equivalent unit
MEM07014B	Perform electro-discharge machining operations (EDM)	Y	No change. Equivalent unit
MEM07015B	Set computer controlled machines/processes	Y	No change. Equivalent unit
MEM07016C	Set and edit computer controlled machines/processes	Y	No change. Equivalent unit
MEM07018C	Write basic NC/CNC programs	Y	No change. Equivalent unit
MEM07019C	Program NC/CNC machining centre	Y	No change. Equivalent unit
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	Y	No change. Equivalent unit
MEM07021B	Perform complex lathe operations	Y	No change. Equivalent unit
MEM07022C	Program CNC wire cut machines	Y	No change. Equivalent unit
MEM07023C	Program and set up CNC manufacturing cell	Y	No change. Equivalent unit
MEM07024B	Operate and monitor machine/process		No change. Equivalent unit
MEM07025B	Perform advanced machine/process operation	Y	No change. Equivalent unit
MEM07026B	Perform advanced plastic processing	Y	No change. Equivalent unit
MEM07027B	Perform advanced press operations	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM07028B	Operate computer controlled machines/processes	Y	No change. Equivalent unit
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	Y	No change. Equivalent unit
MEM07030C	Perform metal spinning lathe operations (basic)	Y	No change. Equivalent unit
MEM07031C	Perform metal spinning lathe operations (complex)	Y	Corrected title of MEM05003B in pre req pathway. Cat 1 change. Unit equivalent.
MEM07032B	Use workshop machines for basic operations	Y	No change. Equivalent unit
MEM07033B	Operate and monitor basic boiler		No change. Equivalent unit
MEM07034A	Operate and monitor intermediate class boiler	Y	No change. Equivalent unit
MEM07039A	Write programs for industrial robots	Y	No change. Equivalent unit
MEM07040A	Set multistage integrated processes	Y	No change. Equivalent unit
MEM08001B	Perform wire, jig and barrel load/unload work		No change. Equivalent unit
MEM08002C	Pre-treat work for subsequent surface coating	Y	No change. Equivalent unit
MEM08003C	Perform electroplating operations	Y	No change. Equivalent unit
MEM08004B	Finish work using wet, dry and vapour deposition methods	Y	No change. Equivalent unit
MEM08005B	Prepare and produce specialised coatings	Y	No change. Equivalent unit
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM08007B	Control surface finish production and finished product quality		No change. Equivalent unit
No change. Equivalent unit MEM08008B	Operate and control surface finishing waste treatment process	Y	No change. Equivalent unit
MEM08009C	Make up solutions	Y	No change. Equivalent unit
MEM08010B	Manually finish/polish materials	Y	No change. Equivalent unit
MEM08011B	Prepare surfaces using solvents and/or mechanical means	Y	No change. Equivalent unit
MEM08012B	Prepare surfaces by abrasive blasting (basic)	Y	No change. Equivalent unit
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	Y	No change. Equivalent unit
MEM08014B	Apply protective coatings (basic)	Y	No change. Equivalent unit
MEM08015B	Apply protective coatings (advanced)	Y	No change. Equivalent unit
MEM08016B	Control blast coating by-products, materials and emissions	Y	No change. Equivalent unit
MEM08018B	Electroplate engineering coatings	Y	No change. Equivalent unit
MEM08019B	Electroplate protective finishes	Y	No change. Equivalent unit
MEM08020B	Electroplate decorative finishes	Y	No change. Equivalent unit
MEM09002B	Interpret technical drawing		No change. Equivalent unit
MEM09003B	Prepare basic engineering drawing	Y	No change. Equivalent unit



<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM09004B	Perform electrical/electronic detail drafting	Y	No change. Equivalent unit
MEM09005B	Perform basic engineering detail drafting	Y	No change. Equivalent unit
MEM09006B	Perform advanced engineering detail drafting	Y	No change. Equivalent unit
MEM09007B	Perform advanced mechanical detail drafting	Y	No change. Equivalent unit
MEM09008B	Perform advanced structural detail drafting	Y	No change. Equivalent unit
MEM09009C	Create 2D drawings using computer aided design system	Y	No change. Equivalent unit
MEM09010C	Create 3D models using computer aided design system	Y	No change. Equivalent unit
MEM09011B	Apply basic engineering design concepts	Y	No change. Equivalent unit
MEM09021B	Interpret and produce curved 3-dimensional shapes		No change. Equivalent unit
MEM09022A	Create 2D code file using computer aided manufacturing system	Y	Correction to unit title Cat 1 change. Unit equivalent.
MEM09023A	Create 3D code files using computer aided manufacturing system	Y	Correction to MEM09022 unit title in pre-req pathway. Cat 1 change. Unit equivalent.
MEM09141A	Represent mechanical engineering designs	Y	No change. Equivalent unit
MEM09142A	Represent mechatronic engineering designs	Y	No change. Equivalent unit
MEM09151A	Apply computer aided modelling and data management techniques to mechanical engineering designs	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM09152A	Apply computer aided modelling and data management techniques to mechatronic engineering designs	Y	No change. Equivalent unit
MEM10001C	Erect structures	Y	No change. Equivalent unit
MEM10002B	Terminate and connect electrical wiring	Y	No change. Equivalent unit
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	Y	No change. Equivalent unit
MEM10004B	Enter and change programmable controller operational parameters	Y	No change. Equivalent unit
MEM10005B	Commission programmable controller programs	Y	No change. Equivalent unit
MEM10006B	Install machine/plant	Y	No change. Equivalent unit
MEM10007C	Modify control systems	Y	No change. Equivalent unit
MEM10008B	Undertake commissioning procedures for plant and/or equipment	Y	No change. Equivalent unit
MEM10009B	Install refrigeration and air conditioning plant and equipment	Y	No change. Equivalent unit
MEM10010B	Install pipework and pipework assemblies	Y	No change. Equivalent unit
MEM10011B	Terminate and connect specialist cables	Y	No change. Equivalent unit
MEM10012A	Install split air conditioning system	Y	Deleted unit.
MEM10013A	Install split air conditioning systems and associated pipework	Y	New unit. Replaces and is not equivalent to MEM10012A
MEM11001C	Erect/dismantle scaffolding and equipment	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM11002C	Erect/dismantle complex scaffolding and equipment	Y	No change. Equivalent unit
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	Y	No change. Equivalent unit
MEM11004B	Undertake dogging	Y	No change. Equivalent unit
MEM11005B	Pick and process order		No change. Equivalent unit
MEM11006B	Perform production packaging		No change. Equivalent unit
MEM11007B	Administer inventory procedures		No change. Equivalent unit
MEM11008B	Package materials (stores and warehouse)		No change. Equivalent unit
MEM11009B	Handle/move bulk fluids/gases		No change. Equivalent unit
MEM11010B	Operate mobile load shifting equipment		No change. Equivalent unit
MEM11011B	Undertake manual handling		No change. Equivalent unit
MEM11012B	Purchase materials		No change. Equivalent unit
MEM11013B	Undertake warehouse receipt process	Y	No change. Equivalent unit
MEM11014B	Undertake warehouse dispatch process	Y	No change. Equivalent unit
MEM11015B	Manage warehouse inventory system	Y	No change. Equivalent unit
MEM11016B	Order materials		No change. Equivalent unit
MEM11017B	Organise and lead stocktakes	Y	No change. Equivalent

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
			unit
MEM11018B	Organise and maintain warehouse stock receival and/or dispatch system	Y	No change. Equivalent unit
MEM11019B	Undertake tool store procedures	Y	No change. Equivalent unit
MEM11020B	Perform advanced warehouse computer operations	Y	No change. Equivalent unit
MEM11021B	Perform advanced operation of load shifting equipment	Y	No change. Equivalent unit
MEM11022B	Operate fixed/moveable load shifting equipment		No change. Equivalent unit
MEM12001B	Use comparison and basic measuring devices		No change. Equivalent unit
MEM12002B	Perform electrical/electronic measurement		No change. Equivalent unit
MEM12003B	Perform precision mechanical measurement	Y	No change. Equivalent unit
MEM12004B	Perform precision electrical/electronic measurement		No change. Equivalent unit
MEM12005B	Calibrate measuring equipment	Y	No change. Equivalent unit
MEM12006B	Mark off/out (general engineering)	Y	No change. Equivalent unit
MEM12007C	Mark off/out structural fabrications and shapes	Y	No change. Equivalent unit
MEM12019B	Measure components using coordinate measuring machines		Minor correction to unit title and descriptor. Cat 1 change. Unit equivalent.
MEM12020B	Set and operate coordinate measuring machines		Minor correction to unit title and descriptor. Cat 1 change. Unit

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
			equivalent.
MEM12021B	Program coordinate measuring machines	Y	Minor correction to unit title and descriptor. Cat 1 change. Unit equivalent.
MEM12022B	Program coordinate measuring machines (advanced)	Y	Minor correction to unit title and descriptor. Cat 1 change. Unit equivalent.
MEM12023A	Perform engineering measurements		No change. Equivalent unit
MEM12024A	Perform computations		No change. Equivalent unit
MEM12025A	Use graphical techniques and perform simple statistical computations	Y	No change. Equivalent unit
MEM13001B	Perform emergency first aid		No change. Equivalent unit
MEM13002B	Undertake occupational health and safety activities in the workplace		No change. Equivalent unit
MEM13003B	Work safely with industrial chemicals and materials		No change. Equivalent unit
MEM13004B	Work safely with molten metals/glass		No change. Equivalent unit
MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise		No change. Equivalent unit
MEM13007B	Maintain water treatment systems for cooling towers	Y	No change. Equivalent unit
MEM13010A	Supervise occupational health and safety in an industrial work environment.	Y	No change. Equivalent unit
MEM13013B	Work safely with ionizing radiation		No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM13014A	Apply principles of occupational health and safety in the work environment		No change. Equivalent unit
MEM14001B	Schedule material deliveries		No change. Equivalent unit
MEM14002B	Undertake basic process planning		No change. Equivalent unit
MEM14003B	Undertake basic production scheduling		No change. Equivalent unit
MEM14004A	Plan to undertake a routine task		No change. Equivalent unit
MEM14005A	Plan a complete activity		No change. Equivalent unit
MEM14061A	Plan and design mechanical engineering projects	Y	No change. Equivalent unit
MEM14062A	Plan and design mechatronic engineering projects	Y	No change. Equivalent unit
MEM14063A	Plan and design manufacturing engineering projects	Y	No change. Equivalent unit
MEM14064A	Plan and design maintenance engineering projects	Y	No change. Equivalent unit
MEM14081A	Apply mechanical engineering fundamentals to support design and development of projects	Y	No change. Equivalent unit
MEM14082A	Apply mechatronics fundamentals to support design and development of engineering projects	Y	No change. Equivalent unit
MEM15001B	Perform basic statistical quality control		No change. Equivalent unit
MEM15002A	Apply quality systems		No change. Equivalent unit
MEM15003B	Use improvement processes in team activities	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM15004B	Perform inspection		No change. Equivalent unit
MEM15005B	Select and control inspection processes and procedures	Y	No change. Equivalent unit
MEM15007B	Conduct product and/or process capability studies	Y	No change. Equivalent unit
MEM15008B	Perform advanced statistical quality control	Y	No change. Equivalent unit
MEM15010B	Perform laboratory procedures		No change. Equivalent unit
MEM15011B	Exercise external quality assurance	Y	No change. Equivalent unit
MEM15012B	Maintain/supervise the application of quality procedures	Y	No change. Equivalent unit
MEM15015B	Examine trading practices	Y	No change. Equivalent unit
MEM15016B	Inspect pre-packed articles	Y	No change. Equivalent unit
MEM15017B	Use and maintain reference standards	Y	No change. Equivalent unit
MEM15018B	Investigate consumer complaints	Y	No change. Equivalent unit
MEM15019B	Conduct a field inspection	Y	No change. Equivalent unit
MEM15020C	Perform verification/certification or in-service inspection	Y	No change. Equivalent unit
MEM15021C	Conduct audits of servicing licensees and public weighbridge licensees	Y	No change. Equivalent unit
MEM15022B	Verify reference standards	Y	No change. Equivalent unit
MEM15024A	Apply quality procedures		No change. Equivalent

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
			unit
MEM16001B	Give formal presentations and take part in meetings		No change. Equivalent unit
MEM16002C	Conduct formal interviews and negotiations		No change. Equivalent unit
MEM16003B	Provide advanced customer service		Correction to PC numbering. Cat 1 change. Unit equivalent.
MEM16004B	Perform internal/external customer service		No change. Equivalent unit
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities		No change. Equivalent unit
MEM16006A	Organise and communicate information		No change. Equivalent unit
MEM16007A	Work with others in a manufacturing, engineering or related environment		No change. Equivalent unit
MEM16008A	Interact with computing technology		No change. Equivalent unit
MEM16009A	Research and analyse engineering information	Y	No change. Equivalent unit
MEM16010A	Write reports	Y	No change. Equivalent unit
MEM16011A	Communicate with individuals and small groups	Y	No change. Equivalent unit
MEM16012A	Interpret technical specifications and manuals		No change. Equivalent unit
MEM16013A	Operate in a self-directed team	Y	No change. Equivalent unit
MEM16014A	Report technical information	Y	No change. Equivalent unit



<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM17001B	Assist in development and deliver training in the workplace		No change. Equivalent unit
MEM17002B	Conduct workplace assessment		No change. Equivalent unit
MEM17003A	Assist in the provision of on the job training		No change. Equivalent unit
MEM18001C	Use hand tools		No change. Equivalent unit
MEM18002B	Use power tools/hand held operations		No change. Equivalent unit
MEM18003C	Use tools for precision work	Y	No change. Equivalent unit
MEM18004B	Maintain and overhaul mechanical equipment	Y	Correction to PC numbering. Cat 1 change. Unit equivalent.
MEM18005B	Perform fault diagnosis, installation and removal of bearings	Y	No change. Equivalent unit
MEM18006B	Repair and fit engineering components	Y	No change. Equivalent unit
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	Y	No change. Equivalent unit
MEM18008B	Balance equipment	Y	No change. Equivalent unit
MEM18009B	Perform levelling and alignment of machines and engineering components	Y	No change. Equivalent unit
MEM18010C	Perform equipment condition monitoring and recording	Y	No change. Equivalent unit
MEM18011C	Shut down and isolate machines/equipment		No change. Equivalent unit
MEM18012B	Perform installation and removal of mechanical seals	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM18013B	Perform gland packing	Y	No change. Equivalent unit
MEM18014B	Manufacture press tools and gauges	Y	No change. Equivalent unit
MEM18015B	Maintain tools and dies	Y	No change. Equivalent unit
MEM18016B	Analyse plant and equipment condition monitoring results	Y	No change. Equivalent unit
MEM18017C	Modify mechanical systems and equipment	Y	No change. Equivalent unit
MEM18018C	Maintain pneumatic system components	Y	No change. Equivalent unit
MEM18019B	Maintain pneumatic systems	Y	No change. Equivalent unit
MEM18020B	Maintain hydraulic system components	Y	No change. Equivalent unit
MEM18021B	Maintain hydraulic systems	Y	No change. Equivalent unit
MEM18022B	Maintain fluid power controls	Y	No change. Equivalent unit
MEM18023B	Modify fluid power system operation	Y	No change. Equivalent unit
MEM18024B	Maintain engine cooling systems	Y	No change. Equivalent unit
MEM18025B	Service combustion engines	Y	No change. Equivalent unit
MEM18026C	Test compression ignition fuel systems	Y	No change. Equivalent unit
MEM18027C	Overhaul engine fuel system components	Y	No change. Equivalent unit
MEM18028B	Maintain engine lubrication systems	Y	No change. Equivalent

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
			unit
MEM18029B	Tune diesel engines	Y	No change. Equivalent unit
MEM18030B	Diagnose and rectify low voltage electrical systems	Y	No change. Equivalent unit
MEM18031B	Diagnose and rectify low voltage starting systems	Y	No change. Equivalent unit
MEM18032B	Maintain induction/exhaust systems	Y	No change. Equivalent unit
MEM18033B	Perform engine bottom-end overhaul	Y	No change. Equivalent unit
MEM18034B	Perform engine top-end overhaul	Y	No change. Equivalent unit
MEM18035B	Diagnose and rectify braking systems	Y	No change. Equivalent unit
MEM18037B	Diagnose and rectify low voltage charging systems	Y	No change. Equivalent unit
MEM18038B	Maintain wheels and tyres	Y	No change. Equivalent unit
MEM18039B	Diagnose and rectify track type undercarriage	Y	No change. Equivalent unit
MEM18040B	Maintain suspension systems	Y	No change. Equivalent unit
MEM18041B	Maintain steering systems	Y	No change. Equivalent unit
MEM18042C	Diagnose and rectify manual transmissions	Y	No change. Equivalent unit
MEM18043C	Diagnose and rectify automatic transmissions	Y	No change. Equivalent unit
MEM18044C	Diagnose and rectify drive line and final drives	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	Y	No change. Equivalent unit
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	Y	No change. Equivalent unit
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	Y	No change. Equivalent unit
MEM18048B	Fault find and repair/rectify basic electrical circuits	Y	No change. Equivalent unit
MEM18049B	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	Y	No change. Equivalent unit
MEM18050B	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	Y	Minor title correction. Cat 1 change. Unit equivalent.
MEM18051B	Fault find and repair/rectify complex electrical circuits	Y	No change. Equivalent unit
MEM18052B	Maintain fluid power systems for mobile plant	Y	No change. Equivalent unit
MEM18053B	Modify fluid power control systems	Y	No change. Equivalent unit
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	Y	No change. Equivalent unit
MEM18055B	Dismantle, replace and assemble engineering components	Y	No change. Equivalent unit
MEM18056B	Diagnose and repair analog equipment and components	Y	No change. Equivalent unit
MEM18057B	Maintain/service analog/digital electronic equipment	Y	No change. Equivalent unit
MEM18058C	Modify electronic equipment	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM18059B	Modify electronic systems	Y	No change. Equivalent unit
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	Y	No change. Equivalent unit
MEM18061B	Maintain/calibrate complex control systems	Y	No change. Equivalent unit
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	Y	No change. Equivalent unit
MEM18063B	Terminate signal and data cables	Y	No change. Equivalent unit
MEM18064B	Maintain instrumentation system components	Y	No change. Equivalent unit
MEM18065B	Diagnose and repair digital equipment and components	Y	No change. Equivalent unit
MEM18066B	Diagnose and repair microprocessor-based equipment	Y	No change. Equivalent unit
MEM18067B	Tune control loops - multi controller or multi element systems	Y	No change. Equivalent unit
MEM18069B	Maintain, repair instrumentation process control analysers	Y	No change. Equivalent unit
MEM18070C	Modify complex electrical circuits and systems	Y	No change. Equivalent unit
MEM18071B	Connect/disconnect fluid conveying system components	Y	No change. Equivalent unit
MEM18072B	Manufacture fluid conveying conductor assemblies	Y	No change. Equivalent unit
MEM18073A	Perform advanced equipment testing and diagnostics on mobile plant and equipment	Y	No change. Equivalent unit
MEM18084A	Commission and decommission split air conditioning systems	Y	New unit. No equivalent.

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	Y	New unit. No equivalent.
MEM18086B	Test, recover, evacuate and charge refrigeration systems	Y	No change. Equivalent unit
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	Y	No change. Equivalent unit
MEM18088B	Maintain and repair commercial air conditioning systems and components	Y	No change. Equivalent unit
MEM18089B	Maintain and repair central air handling systems	Y	No change. Equivalent unit
MEM18090B	Maintain and repair industrial refrigeration systems and components	Y	No change. Equivalent unit
MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	Y	No change. Equivalent unit
MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	Y	No change. Equivalent unit
MEM18093B	Maintain and repair integrated industrial refrigeration and/or large air handling system controls	Y	No change. Equivalent unit
MEM18094B	Service and repair commercial refrigeration	Y	No change. Equivalent unit
MEM18095A	Maintain and repair cooling towers/evaporative condensers and associated equipment	Y	No change. Equivalent unit
MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	Y	No change. Equivalent unit
MEM18097A	Manufacture cavity dies	Y	No change. Equivalent unit
MEM19001B	Perform jewellery metal casting	Y	No change. Equivalent

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
			unit
MEM19002B	Prepare jewellery illustrations	Y	No change. Equivalent unit
MEM19003B	Handle gem materials		No change. Equivalent unit
MEM19004B	Handle and examine gemstone materials	Y	No change. Equivalent unit
MEM19005B	Produce three-dimensional precision items	Y	No change. Equivalent unit
MEM19006B	Replace watch batteries	Y	No change. Equivalent unit
MEM19007B	Perform gemstone setting	Y	No change. Equivalent unit
MEM19008B	Prepare jewellery designs	Y	No change. Equivalent unit
MEM19009B	Perform investment procedures for lost wax casting process	Y	No change. Equivalent unit
MEM19010B	Produce rubber moulds for lost wax casting process		No change. Equivalent unit
MEM19011B	Perform wax injection of moulds for lost wax casting process		No change. Equivalent unit
MEM19012B	Produce jewellery wax model	Y	No change. Equivalent unit
MEM19013B	Produce jewellery metal masters	Y	No change. Equivalent unit
MEM19014B	Perform hand engraving	Y	No change. Equivalent unit
MEM19015B	Perform jewellery enamelling	Y	No change. Equivalent unit
MEM19016B	Construct jewellery components	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM19017B	Fabricate jewellery items	Y	No change. Equivalent unit
MEM19018B	Repair jewellery items	Y	No change. Equivalent unit
MEM19020B	Fault-find and maintain micro-mechanisms	Y	No change. Equivalent unit
MEM19021B	Diagnose and service micro-mechanisms	Y	No change. Equivalent unit
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	Y	No change. Equivalent unit
MEM20001A	Produce keys		No change. Equivalent unit
MEM20002A	Assemble and test lock mechanisms	Y	No change. Equivalent unit
MEM20003A	Install and upgrade locks and hardware	Y	No change. Equivalent unit
MEM20004A	Gain entry	Y	No change. Equivalent unit
MEM20005A	Install and maintain door control devices/systems	Y	No change. Equivalent unit
MEM20006A	Maintain and service mechanical locking devices	Y	No change. Equivalent unit
MEM20007A	Plan and prepare a masterkey system	Y	Pre-requisite correction. Cat 1 change. Unit equivalent.
MEM20008A	Develop and implement a masterkey system	Y	Pre-requisite correction. Cat 1 change. Unit equivalent.
MEM20009A	Gain entry and reinstate fire and security containers	Y	No change. Equivalent unit
MEM20010A	Gain entry and reinstate automotive locking systems	Y	No change. Equivalent unit



<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM20011A	Service and repair fire and security containers	Y	No change. Equivalent unit
MEM20012A	Service and repair mechanical automotive locking systems	Y	No change. Equivalent unit
MEM20013A	Service automotive transponder systems	Y	No change. Equivalent unit
MEM20014A	Perform a site security survey		No change. Equivalent unit
MEM22001A	Perform engineering activities	Y	No change. Equivalent unit
MEM22002A	Manage self in the engineering environment	Y	No change. Equivalent unit
MEM22003A	Manage engineering resources	Y	No change. Equivalent unit
MEM22004A	Manage engineering projects	Y	No change. Equivalent unit
MEM22005A	Manage engineering operations	Y	No change. Equivalent unit
MEM22006A	Source and estimate materials	Y	No change. Equivalent unit
MEM22007A	Manage environmental effects of engineering activities	Y	No change. Equivalent unit
MEM22008A	Manage change and technical development	Y	No change. Equivalent unit
MEM22009A	Manage technical sales and promotion	Y	No change. Equivalent unit
MEM23001A	Apply advanced mathematical techniques in a manufacturing engineering or related environment	Y	No change. Equivalent unit
MEM23002A	Apply calculus in engineering situations	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM23003A	Operate and program computers and/or controllers in engineering situations	Y	No change. Equivalent unit
MEM23041A	Apply basic scientific principles and techniques in mechanical engineering situations		No change. Equivalent unit
MEM23051A	Apply basic electro and control scientific principles and techniques in mechanical and manufacturing engineering situations		No change. Equivalent unit
MEM23061A	Select and test mechanical engineering materials		Updated reference to National Measurement Institute. Cat 1 change. Unit equivalent.
MEM23062A	Select and test mechatronic engineering materials		Updated reference to National Measurement Institute. Cat 1 change. Unit equivalent.
MEM23071A	Select and apply mechanical engineering methods, processes and construction techniques		No change. Equivalent unit
MEM23072A	Select and apply mechatronic engineering methods, processes and construction techniques		No change. Equivalent unit
MEM23081A	Apply scientific principles and techniques in mechanical engineering situations	Y	No change. Equivalent unit
MEM23082A	Apply scientific principles and techniques in mechatronic engineering situations	Y	No change. Equivalent unit
MEM23083A	Apply industrial engineering principles and techniques in competitive manufacturing engineering situations	Y	No change. Equivalent unit
MEM23091A	Apply mechanical system design principles and techniques in mechanical engineering situations	Y	No change. Equivalent unit
MEM23092A	Apply automated systems principles and techniques in engineering situations	Y	Corrected "automotive" to "automated" Cat 1 change.

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
			Unit equivalent.
MEM23093A	Apply plant and process design principles and techniques in engineering situations	Y	Corrected reference to "no" prerequisites. Cat 1 change. Unit equivalent.
MEM23094A	Apply maintenance systems principles and techniques in engineering situations	Y	No change. Equivalent unit
MEM24001B	Perform basic penetrant testing	Y	No change. Equivalent unit
MEM24002B	Perform penetrant testing	Y	No change. Equivalent unit
MEM24003B	Perform basic magnetic particle testing	Y	No change. Equivalent unit
MEM24004B	Perform magnetic particle testing	Y	No change. Equivalent unit
MEM24005B	Perform basic eddy current testing	Y	No change. Equivalent unit
MEM24006B	Perform eddy current testing	Y	No change. Equivalent unit
MEM24007B	Perform ultrasonic thickness testing	Y	No change. Equivalent unit
MEM24008B	Perform ultrasonic testing	Y	No change. Equivalent unit
MEM24009B	Perform basic radiographic testing	Y	No change. Equivalent unit
MEM24010B	Perform radiographic testing	Y	No change. Equivalent unit
MEM24011B	Establish non-destructive tests	Y	No change. Equivalent unit
MEM24012B	Apply metallurgy principles		No change. Equivalent unit
MEM25001B	Apply fibre-reinforced materials	Y	No change. Equivalent

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
			unit
MEM25002B	Form and integrate fibre-reinforced structures	Y	No change. Equivalent unit
MEM25003B	Set up marine vessel structures	Y	No change. Equivalent unit
MEM25004B	Fair and shape surfaces	Y	No change. Equivalent unit
MEM25005B	Construct and assemble marine vessel timber components	Y	No change. Equivalent unit
MEM25006B	Undertake marine sheathing operations	Y	No change. Equivalent unit
MEM25007B	Maintain marine vessel surfaces	Y	No change. Equivalent unit
MEM25008B	Repair marine vessel surfaces and structures	Y	No change. Equivalent unit
MEM25009B	Form timber shapes using hot processes	Y	No change. Equivalent unit
MEM25010B	Perform fitout procedures	Y	No change. Equivalent unit
MEM25011B	Install marine systems	Y	No change. Equivalent unit
MEM25012B	Install and test operations of marine auxiliary systems	Y	No change. Equivalent unit
MEM25013B	Produce three-dimensional plugs/moulds	Y	No change. Equivalent unit
MEM25014B	Perform marine slipping operations	Y	No change. Equivalent unit
MEM25015A	Assemble and install equipment and accessories/ancillaries		No change. Equivalent unit
MEM30001A	Use computer aided drafting systems to produce basic engineering drawings	Y	No change. Equivalent unit

<b>MEM05 Unit code</b>	<b>MEM05 Unit title</b>	<b>P</b>	<b>Relationship to previous training package version</b>
MEM30002A	Produce basic engineering graphics	Y	No change. Equivalent unit
MEM30003A	Produce detailed engineering drawings	Y	No change. Equivalent unit
MEM30004A	Use CAD to create and display 3D models	Y	Corrected pre-requisite. Cat 1 change. Unit equivalent.
MEM30005A	Calculate force systems within simple beam structures	Y	No change. Equivalent unit
MEM30006A	Calculate stresses in simple structures	Y	No change. Equivalent unit
MEM30007A	Select common engineering materials		No change. Equivalent unit
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications		No change. Equivalent unit
MEM30009A	Contribute to the design of basic mechanical systems	Y	No change. Equivalent unit
MEM30010A	Set up basic hydraulic circuits		No change. Equivalent unit
MEM30011A	Set up basic pneumatic circuits		No change. Equivalent unit
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment		No change. Equivalent unit
MEM30013A	Assist in the preparation of a basic workplace layout		No change. Equivalent unit
MEM30014A	Apply basic just in time systems to the reduction of waste		No change. Equivalent unit
MEM30015A	Develop recommendations for basic set up time improvements		No change. Equivalent unit
MEM30016A	Assist in the analysis of a supply chain		No change. Equivalent

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
			unit
MEM30017A	Use basic preventative maintenance techniques and tools		No change. Equivalent unit
MEM30018A	Undertake basic process planning		No change. Equivalent unit
MEM30019A	Use resource planning software systems in manufacturing	Y	No change. Equivalent unit
MEM30020A	Develop and manage a plan for a simple manufacturing related project		No change. Equivalent unit
MEM30021A	Prepare a simple production schedule		No change. Equivalent unit
MEM30022A	Undertake supervised procurement activities		No change. Equivalent unit
MEM30023A	Prepare a simple cost estimate for a manufactured product		No change. Equivalent unit
MEM30024A	Participate in quality assurance techniques	Y	No change. Equivalent unit
MEM30025A	Analyse a simple electrical system circuit	Y	No change. Equivalent unit
MEM30026A	Select and test components for simple electronic switching and timing circuits	Y	No change. Equivalent unit
MEM30027A	Prepare basic programs for programmable logic controllers		No change. Equivalent unit
MEM30028A	Assist in sales of technical products/systems		No change. Equivalent unit
MEM50001B	Classify recreational boating technologies and features		No change. Equivalent unit
MEM50002B	Work safely on marine craft		No change. Equivalent unit
MEM50003B	Follow work procedures to maintain the marine environment		No change. Equivalent unit

MEM05 Unit code	MEM05 Unit title	P	Relationship to previous training package version
MEM50004B	Maintain quality of environment by following marina codes	Y	No change. Equivalent unit
MEM50005B	Refuel vessels	Y	No change. Equivalent unit
MEM50006B	Check operational capability of marine craft	Y	No change. Equivalent unit
MEM50007B	Check operational capability of sails and sail operating equipment	Y	No change. Equivalent unit
MEM50008B	Carry out trip preparation and planning		No change. Equivalent unit
MEM50009B	Safely operate a mechanically powered recreational boat		No change. Equivalent unit
MEM50010B	Respond to boating emergencies and incidents		No change. Equivalent unit

### Explanation of the review date

The review date (shown on the title page and in the header of each page) indicates when the Training Package is expected to be reviewed in the light of changes such as changing technologies and circumstances. The review date is not an expiry date. Endorsed Training Packages and their components remain current until they are reviewed or replaced.

## Summary of AQF Qualifications in this Package

AQF Qualifications in MEM05v11

MEM10105	Certificate I in Engineering
MEM10205	Certificate I in Boating Services
MEM20105	Certificate II in Engineering
MEM20205	Certificate II in Engineering - Production Technology
MEM20305	Certificate II in Boating Services

MEM20413	Certificate II in Engineering Pathways
MEM30105	Certificate III in Engineering - Production Systems
MEM30205	Certificate III in Engineering - Mechanical Trade
MEM30305	Certificate III in Engineering - Fabrication Trade
MEM30405	Certificate III in Engineering - Electrical/Electronic Trade
MEM30505	Certificate III in Engineering - Technical
MEM30605	Certificate III in Jewellery Manufacture
MEM30705	Certificate III in Marine Craft Construction
MEM30805	Certificate III in Locksmithing
MEM30905	Certificate III in Boating Services
MEM31010	Certificate III in Watch and Clock Service and Repair
MEM31112	Certificate III in Engineering (Composites Trade)
MEM40105	Certificate IV in Engineering
MEM40205	Certificate IV in Boating Services
MEM40311	Certificate IV in Advanced Jewellery Manufacture
MEM40412	Certificate IV in Engineering Drafting
MEM50105	Diploma of Engineering - Advanced Trade
MEM50212	Diploma of Engineering - Technical
MEM50311	Diploma of Jewellery and Object Design
MEM60112	Advanced Diploma of Engineering
MEM60211	Advanced Diploma of Jewellery and Object Design
MEM80112	Vocational Graduate Diploma of Engineering



## List of MEM05v11 Units within Training Package

Refer to Appendix 1: MEM05 Units, prerequisites, points and weighting

## Certificate III Trade Specialisation Units

Refer Appendix 2: Certificate III Trade Specialisation Units

## List of Imported units in MEM Training Package

Refer to Appendix 3: Imported units of competency and points and weighting

## Overview

### What is a Training Package?

A Training Package is an integrated set of nationally endorsed competency standards, assessment guidelines and Australian Qualifications Framework (AQF) qualifications for a specific industry, industry sector or enterprise.

Each Training Package:

- provides a consistent and reliable set of components for training, recognising and assessing people's skills, and may also have optional support materials
- enables nationally recognised qualifications to be awarded through direct assessment of workplace competencies
- encourages the development and delivery of flexible training which suits individual and industry requirements
- encourages learning and assessment in a work-related environment which leads to verifiable workplace outcomes.

### How do Training Packages fit within the National Skills Framework?

The National Skills Framework applies nationally, is endorsed by the Ministerial Council for Vocational and Technical Education, and comprises the Australian Quality Training Framework 2010 (AQTF 2010), and Training Packages endorsed by the National Skills Standards Council (NSSC).

### How are Training Packages developed?

Training Packages are developed by Industry Skills Councils or enterprises to meet the identified training needs of specific industries or industry sectors. To gain national endorsement of Training Packages, developers must provide evidence of extensive research, consultation and support within the industry area or enterprise.

### How do Training Packages encourage flexibility?

Training Packages describe the skills and knowledge needed to perform effectively in the workplace without prescribing how people should be trained. Training Packages acknowledge that people can achieve vocational competency in many ways by emphasising what the learner can do, not how or where they learned to do it. For example, some experienced workers might be able to demonstrate competency against the units of competency, and even gain a qualification, without completing a formal training program.

With Training Packages, assessment and training may be conducted at the workplace, off-the-job, at a training organisation, during regular work, or through work experience, work placement, work simulation or any combination of these.

### Who can deliver and assess using Training Packages?

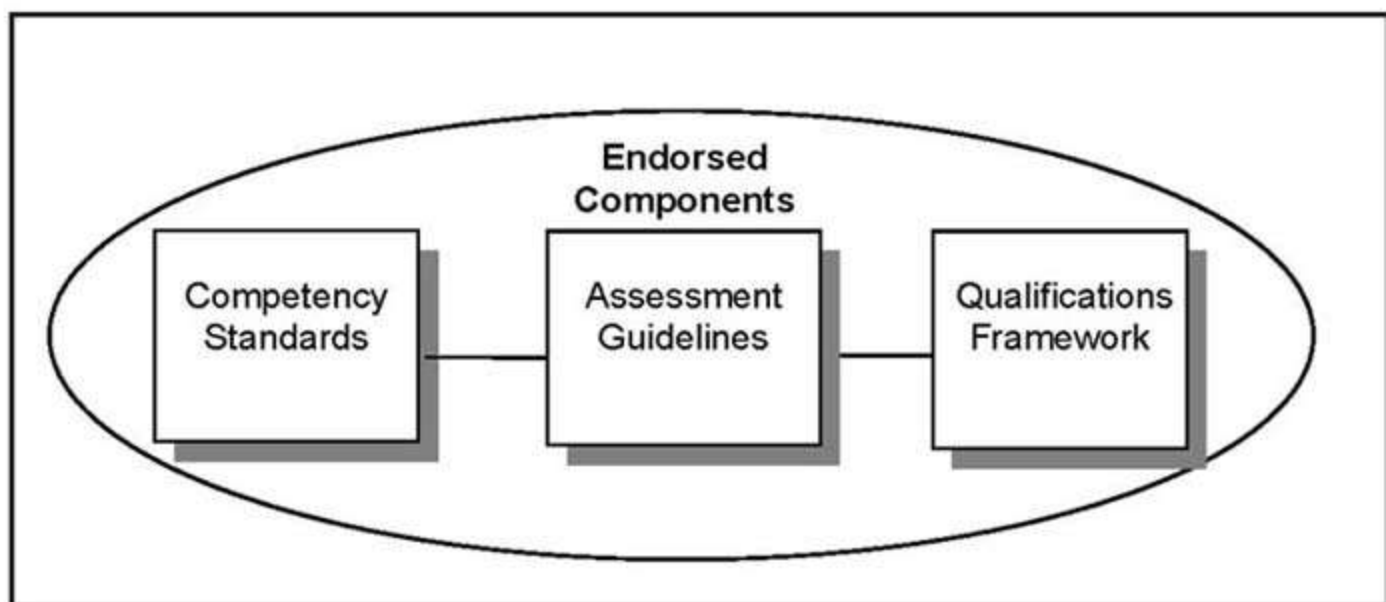
Training and assessment using Training Packages must be conducted by a Registered Training Organisation (RTO) that has the qualifications or specific units of competency on its scope of registration, or that works in partnership with another RTO, as specified in the AQTF 2010.

### Training Package Components

Training Packages are made up of mandatory components endorsed by the NQC, and optional support materials.

### Training Package Endorsed Components

The nationally endorsed components include the Competency Standards, Assessment Guidelines and Qualifications Framework. These form the basis of training and assessment in the Training Package and, as such, they must be used.



## Competency Standards

Each unit of competency identifies a discrete workplace requirement and includes the knowledge and skills that underpin competency as well as language, literacy and numeracy; and occupational health and safety requirements. The units of competency must be adhered to in training and assessment to ensure consistency of outcomes.

## Assessment Guidelines

The Assessment Guidelines provide an industry framework to ensure all assessments meet industry needs and nationally agreed standards as expressed in the Training Package and the AQTF 2010. The Assessment Guidelines must be followed to ensure the integrity of assessment leading to nationally recognised qualifications.

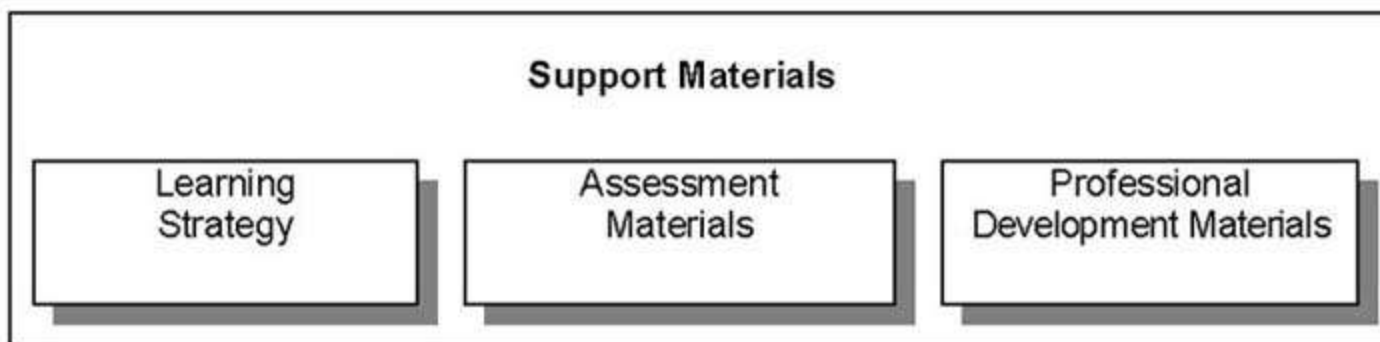
## Qualifications Framework

Each Training Package provides details of those units of competency that must be achieved to award AQF qualifications. The rules around which units of competency can be combined to make up a valid AQF qualification in the Training Package are referred to as the "packaging rules". The packaging rules must be followed to ensure the integrity of nationally recognised qualifications issued.

## Training Package Support Materials

The endorsed components of Training Packages are complemented and supported by optional support materials that provide for choice in the design of training and assessment to meet the needs of industry and learners.

Training Package support materials can relate to single or multiple units of competency, an industry sector, a qualification or the whole Training Package. They tend to fall into one or more of the categories illustrated below.



Training Package support materials are produced by a range of stakeholders, such as RTOs, individual trainers and assessors, private and commercial developers and government agencies.

## Training Package, Qualification and Unit of Competency Codes

There are agreed conventions for the national codes used for Training Packages and their components. Always use the correct codes, exactly as they appear in the Training Package, **and with the code always before the title.**

### Training Package Codes

Each Training Package has a unique five-character national code assigned when the Training Package is endorsed, for example MEM05. The first three characters are letters identifying the Training Package industry coverage and the last two characters are numbers identifying the year of endorsement.

### Qualification Codes

Within each Training Package, each qualification has a unique eight-character code, for example MEM10105. Qualification codes are developed as follows:

- the first three letters identify the Training Package;
- the first number identifies the qualification level (noting that, in the qualification titles themselves, arabic numbers are **not** used);
- the next two numbers identify the position in the sequence of the qualification at that level; and
- the last two numbers identify the year in which the qualification was endorsed. (Where qualifications are added after the initial Training Package endorsement, the last two numbers may differ from other Training Package qualifications as they identify the year in which those particular qualifications were endorsed.)

### Unit of Competency Codes

Within each Training Package, each unit of competency has a unique code. Unit of competency codes are assigned when the Training Package is endorsed, or when new units of competency are added to an existing endorsed Training Package. Unit codes are developed as follows:

- a typical code is made up of 12 characters, normally a mixture of uppercase letters and numbers, as in MEM04020A;
- the first three characters signify the Training Package - MEM05 - in the above example and up to eight characters, relating to an industry sector, function or skill area, follow;
- the last character is always a letter and identifies the unit of competency version. An "A" at the end of the code indicates that this is the original unit of competency. "B", or another incremented version identifier means that minor changes have been made. Typically this would mean that wording has changed in the range statement or evidence guide, providing clearer intent; and
- where changes are made that alter the outcome, a new code is assigned and the title is changed.

### Training Package, Qualification and Unit of Competency Titles

There are agreed conventions for titling Training Packages and their components. Always use the correct titles, exactly as they appear in the Training Package, and with the code always placed before the title.

### **Training Package Titles**

The title of each endorsed Training Package is unique and relates the Training Packages broad industry coverage.

### **Qualification Titles**

The title of each endorsed Training Package qualification is unique. Qualification titles use the following sequence:

- first, the qualification is identified as either Certificate I, Certificate II, Certificate III, Certificate IV, Diploma, Advanced Diploma, Vocational Graduate Certificate, or Vocational Graduate Diploma;
- this is followed by the words "in" for Certificates I to IV, and "of" for Diploma, Advanced Diploma, Vocational Graduate Certificate and Vocational Graduate Diploma;
- then, the industry descriptor, for example Telecommunications;
- and then, if applicable, the occupational or functional stream in brackets, for example (Computer Systems).

For example:

- MEM10105 Certificate I in Engineering

### **Unit of Competency Titles**

Each unit of competency title is unique. Unit of competency titles describe the competency outcome concisely, and are written in sentence case.

For example:

- MEM03001B Perform manual production assembly

### **The revised MEM05 Metal and Engineering Training Package**

The MEM05 Metal and Engineering Training Package was developed to replace the MEM98 Metal and Engineering Training Package. The Training Package is designed to meet the training and skills recognition needs of the Australian engineering industry sector. It covers the competencies used by people employed in the manufacturing, engineering and related services industries.

It also provides access to the apprenticeship streams provided by the National Metal and Engineering Industry Competency Standards leading to national qualifications, with traineeship pathways also available. It also enables further career advancement beyond trade apprenticeship and technical traineeship, with progression to Advanced Diploma.

New qualifications for technical workers were added to MEM05 to more accurately reflect the nature of their work. These qualifications make a distinction between technical work and that of tradespersons. In particular, a new Diploma and Advanced Diploma of Engineering were developed to meet the needs of technical workers and para-professionals in the engineering field. For the current Training Package, four disciplines were selected as priority areas. These disciplines are as follows:

- Mechanical
- Mechatronics
- Maintenance
- Manufacturing

Other disciplines will be added to the qualifications over the life of the Training Package.

There occurred a simplification of some of the qualification titles, as well as changes to the list of qualification descriptors that may be added by RTOs.

The bank of units of competency was revised and extended. Part of the revision included bringing all units to the current approved format. Further information was added to each unit to assist users.

## Qualifications Framework

### The Australian Qualifications Framework

#### What is the Australian Qualifications Framework?

A brief overview of the Australian Qualifications Framework (AQF) follows. For a full explanation of the AQF, see the *AQF Implementation Handbook*.

[http://www.aqf.edu.au/Portals/0/Documents/Handbook/AQF\\_Handbook\\_07.pdf](http://www.aqf.edu.au/Portals/0/Documents/Handbook/AQF_Handbook_07.pdf)

The AQF provides a comprehensive, nationally consistent framework for all qualifications in post-compulsory education and training in Australia. In the vocational education and training (VET) sector it assists national consistency for all trainees, learners, employers and providers by enabling national recognition of qualifications and Statements of Attainment.

Training Package qualifications in the VET sector must comply with the titles and guidelines of the AQF. Endorsed Training Packages provide a unique title for each AQF qualification which must always be reproduced accurately.

#### Qualifications

Training Packages can incorporate the following eight AQF qualifications.

- Certificate I in ...
- Certificate II in ...
- Certificate III in ...
- Certificate IV in ...
- Diploma of ...
- Advanced Diploma of ...
- Vocational Graduate Certificate of ...

- Vocational Graduate Diploma of ...

On completion of the requirements defined in the Training Package, a Registered Training Organisation (RTO) may issue a nationally recognised AQF qualification. Issuance of AQF qualifications must comply with the advice provided in the *AQF Implementation Handbook* and the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **Statement of Attainment**

A Statement of Attainment is issued by a Registered Training Organisation when an individual has completed one or more units of competency from nationally recognised qualification(s)/courses(s). Issuance of Statements of Attainment must comply with the advice provided in the current *AQF Implementation Handbook* and the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

Under the AQTF 2010, RTOs must recognise the achievement of competencies as recorded on a qualification or Statement of Attainment issued by other RTOs. Given this, recognised competencies can progressively build towards a full AQF qualification.

### **AQF Guidelines and Learning Outcomes**

The *AQF Implementation Handbook* provides a comprehensive guideline for each AQF qualification. A summary of the learning outcome characteristics and their distinguishing features for each VET related AQF qualification is provided below.

## **Certificate I**

### *Characteristics of Learning Outcomes*

Breadth, depth and complexity of knowledge and skills would prepare a person to perform a defined range of activities most of which may be routine and predictable.

Applications may include a variety of employment related skills including preparatory access and participation skills, broad-based induction skills and/or specific workplace skills. They may also include participation in a team or work group.

### *Distinguishing Features of Learning Outcomes*

Do the competencies enable an individual with this qualification to:

- demonstrate knowledge by recall in a narrow range of areas;
- demonstrate basic practical skills, such as the use of relevant tools;
- perform a sequence of routine tasks given clear direction
- receive and pass on messages/information.

## **Certificate II**

### *Characteristics of Learning Outcomes*

Breadth, depth and complexity of knowledge and skills would prepare a person to perform in a range of varied activities or knowledge application where there is a clearly defined range of contexts in which the choice of actions required is usually clear and there is limited complexity in the range of operations to be applied.

Performance of a prescribed range of functions involving known routines and procedures and some accountability for the quality of outcomes.

Applications may include some complex or non-routine activities involving individual responsibility or autonomy and/or collaboration with others as part of a group or team.

#### *Distinguishing Features of Learning Outcomes*

Do the competencies enable an individual with this qualification to:

- demonstrate basic operational knowledge in a moderate range of areas;
- apply a defined range of skills;
- apply known solutions to a limited range of predictable problems;
- perform a range of tasks where choice between a limited range of options is required;
- assess and record information from varied sources;
- take limited responsibility for own outputs in work and learning.

### **Certificate III**

#### *Characteristics of Learning Outcomes*

Breadth, depth and complexity of knowledge and competencies would cover selecting, adapting and transferring skills and knowledge to new environments and providing technical advice and some leadership in resolution of specified problems. This would be applied across a range of roles in a variety of contexts with some complexity in the extent and choice of options available.

Performance of a defined range of skilled operations, usually within a range of broader related activities involving known routines, methods and procedures, where some discretion and judgement is required in the selection of equipment, services or contingency measures and within known time constraints.

Applications may involve some responsibility for others. Participation in teams including group or team co-ordination may be involved.

#### *Distinguishing Features of Learning Outcomes*

Do the competencies enable an individual with this qualification to:

- demonstrate some relevant theoretical knowledge
- apply a range of well-developed skills
- apply known solutions to a variety of predictable problems
- perform processes that require a range of well-developed skills where some discretion and judgement is required
- interpret available information, using discretion and judgement
- take responsibility for own outputs in work and learning
- take limited responsibility for the output of others.

### **Certificate IV**

#### *Characteristics of Learning Outcomes*

Breadth, depth and complexity of knowledge and competencies would cover a broad range of varied activities or application in a wider variety of contexts most of which are complex and non-routine. Leadership and guidance are involved when organising activities of self and others as well as contributing to technical solutions of a non-routine or contingency nature.



Performance of a broad range of skilled applications including the requirement to evaluate and analyse current practices, develop new criteria and procedures for performing current practices and provision of some leadership and guidance to others in the application and planning of the skills. Applications involve responsibility for, and limited organisation of, others.

### *Distinguishing Features of Learning Outcomes*

Do the competencies enable an individual with this qualification to:

- demonstrate understanding of a broad knowledge base incorporating some theoretical concepts
- apply solutions to a defined range of unpredictable problems
- identify and apply skill and knowledge areas to a wide variety of contexts, with depth in some areas
- identify, analyse and evaluate information from a variety of sources
- take responsibility for own outputs in relation to specified quality standards
- take limited responsibility for the quantity and quality of the output of others.

## **Diploma**

### *Characteristics of Learning Outcomes*

Breadth, depth and complexity covering planning and initiation of alternative approaches to skills or knowledge applications across a broad range of technical and/or management requirements, evaluation and co-ordination.

The self directed application of knowledge and skills, with substantial depth in some areas where judgment is required in planning and selecting appropriate equipment, services and techniques for self and others.

Applications involve participation in development of strategic initiatives as well as personal responsibility and autonomy in performing complex technical operations or organising others. It may include participation in teams including teams concerned with planning and evaluation functions. Group or team co-ordination may be involved.

The degree of emphasis on breadth as against depth of knowledge and skills may vary between qualifications granted at this level.

### *Distinguishing Features of Learning Outcomes*

Do the competencies or learning outcomes enable an individual with this qualification to:

- demonstrate understanding of a broad knowledge base incorporating theoretical concepts, with substantial depth in some areas
- analyse and plan approaches to technical problems or management requirements
- transfer and apply theoretical concepts and/or technical or creative skills to a range of situations
- evaluate information, using it to forecast for planning or research purposes
- take responsibility for own outputs in relation to broad quantity and quality parameters
- take some responsibility for the achievement of group outcomes.

## Advanced Diploma

### *Characteristics of Learning Outcomes*

Breadth, depth and complexity involving analysis, design, planning, execution and evaluation across a range of technical and/or management functions including development of new criteria or applications or knowledge or procedures.

The application of a significant range of fundamental principles and complex techniques across a wide and often unpredictable variety of contexts in relation to either varied or highly specific functions. Contribution to the development of a broad plan, budget or strategy is involved and accountability and responsibility for self and others in achieving the outcomes is involved.

Applications involve significant judgement in planning, design, technical or leadership/guidance functions related to products, services, operations or procedures.

The degree of emphasis on breadth as against depth of knowledge and skills may vary between qualifications granted at this level.

### *Distinguishing Features of Learning Outcomes*

Do the competencies or learning outcomes enable an individual with this qualification to:

- demonstrate understanding of specialised knowledge with depth in some areas
- analyse, diagnose, design and execute judgements across a broad range of technical or management functions
- generate ideas through the analysis of information and concepts at an abstract level
- demonstrate a command of wide-ranging, highly specialised technical, creative or conceptual skills
- demonstrate accountability for personal outputs within broad parameters
- demonstrate accountability for personal and group outcomes within broad parameters.

## Vocational Graduate Certificate

### *Characteristics of competencies or learning outcomes*

- The self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.
- Substantial breadth and complexity involving the initiation, analysis, design, planning, execution and evaluation of technical and management functions in highly varied and highly specialised contexts.
- Applications involve making significant, high-level, independent judgements in major broad or planning, design, operational, technical and management functions in highly varied and specialised contexts. They may include responsibility and broad-ranging accountability for the structure, management and output of the work or functions of others.
- The degree of emphasis on breadth, as opposed to depth, of knowledge and skills may vary between qualifications granted at this level.

### *Distinguishing features of learning outcomes*

- Demonstrate the self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.

- Initiate, analyse, design, plan, execute and evaluate major broad or technical and management functions in highly varied and highly specialised contexts.
- Generate and evaluate ideas through the analysis of information and concepts at an abstract level.
- Demonstrate a command of wide-ranging, highly specialised technical, creative or conceptual skills in complex contexts.
- Demonstrate responsibility and broad-ranging accountability for the structure, management and output of the work or functions of others.

## Vocational Graduate Diploma

### *Characteristics of competencies or learning outcomes*

- The self-directed development and achievement of broad and specialised areas of knowledge and skills, building on prior knowledge and skills.
- Substantial breadth, depth and complexity involving the initiation, analysis, design, planning, execution and evaluation of major functions, both broad and highly specialised, in highly varied and highly specialised contexts.
- Further specialisation within a systematic and coherent body of knowledge.
- Applications involve making high-level, fully independent, complex judgements in broad planning, design, operational, technical and management functions in highly varied and highly specialised contexts. They may include full responsibility and accountability for all aspects of work and functions of others, including planning, budgeting and strategy development.
- The degree of emphasis on breadth, as opposed to depth, of knowledge and skills may vary between qualifications granted at this level.

### *Distinguishing features of learning outcomes*

Demonstrate the self-directed development and achievement of broad and highly specialised areas of knowledge and skills, building on prior knowledge and skills.

- Initiate, analyse, design, plan, execute and evaluate major functions, both broad and within highly varied and highly specialised contexts.
- Generate and evaluate complex ideas through the analysis of information and concepts at an abstract level.
- Demonstrate an expert command of wide-ranging, highly specialised, technical, creative or conceptual skills in complex and highly specialised or varied contexts.
- Demonstrate full responsibility and accountability for personal outputs.
- Demonstrate full responsibility and accountability for all aspects of the work or functions of others, including planning, budgeting and strategy.
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## MEM05 Qualification Pathways

The following pathways charts are provided to show the types of pathways into and from qualifications that are possible with this Training Package. For more information about qualifications and pathways contact Manufacturing Industry Skills Council (<http://www.mskills.com.au>)

Approved occupational or functional pathway descriptors for use in qualification titles are listed in the section below - Qualification titles - additional descriptors.

Reference to other occupational or functional pathways may be included on any qualification statement that is issued. This could be achieved by adding a pathway descriptor below the formal title of the qualification as shown in example 1 or by an additional sentence as shown in example 2 below.

### **Example 1**

*Certificate III in Engineering - Production Systems*

CNC machine operations pathway

### **Example 2**

*Certificate III in Engineering - Production Systems*

Achieved through the CNC machine operations pathway

Competency 'fields' may give some guidance when selecting units of competency to suit a particular qualification industry descriptor and/or occupational or functional descriptor. For instance, the Maintenance and Diagnostics field contains units that may be suitable for the qualification in the above example focussing on Mechanical Trade (Refrigeration and Air-conditioning).

Note that fields do not set up barriers to accessing the various qualifications. Units may be drawn from a number of fields to form a qualification. More information on competency fields can be found in the section Competency standards overview.

### **Prerequisite Units and Paths**

The prerequisite units section within a unit of competency indicates whether other specific competencies are required to support those competencies included in that particular unit. For example: A person must have the competencies included in the unit MEM13004B Work safely with molten metals/glass before they can acquire the competencies required by a number of other units in the Casting and Moulding field, such as MEM04001B Operate melting furnaces.

Where there are options within the pre-requisites then separate combinations or paths are shown. Where multiple paths (path 1, path 2 etc.) are shown then the most appropriate path should be chosen.

## Qualification Pathways

There are many ways in which a person can gain a national qualification. Existing employees, trainees, apprentices, or pre-employment students may obtain qualifications. The achievement of competence is what matters, not the way in which it is achieved.

Possible pathways may include:

- assessment only pathway
- combination of on-the-job and institution-based training
- institution-based training programs
- on-the-job training

## Skills recognition pathways including New Apprenticeships

The Metal and Engineering Training Package provides national qualification outcomes based on recognition of competency achievement. These qualifications can be accessed through traineeship and apprenticeship pathways available under the New Apprenticeship System.

These qualifications may also be achieved through other pathways which do not involve a contract of training, such as recognition of prior learning.

However in all cases, achievement or recognition of competence is necessary in all of the required units of competency to be awarded a national qualification.

## Customisation of qualifications

### Selection and use of Units of Competency

All qualifications in the Metal and Engineering Training Package have the capacity for customisation to suit the needs of enterprises and learners. Options for selecting units of competency are included to enable customised training pathways to be followed and recognised by a qualification. In addition, the Range of Variables in the units of competency are designed to provide sufficient scope for the application of the units across the spectrum of work performed in Metal and Engineering and related industries.

There is further scope for customisation of each qualification through the inclusion of units of competency drawn from other endorsed Training Packages. RTOs should exercise care to ensure that those units do not duplicate existing MEM05 units. The packaging rules for each qualification provide further information on how much of each qualification can be comprised of non-MEM05 units of competency. The selection of the units of competency applies where the non-MEM05 units are available for inclusion at the same qualification level.

**NOTE:**

MEM05 also contains "imported" units of competency. These units are formally introduced by MSA into MEM05 from other training packages. Imported units form part of the bank of available units in selected qualifications. They do not relate to the customisation guidelines in the preceding paragraph.

It is the responsibility of the RTO to determine the relative points value of any units drawn from other Training Packages. When determining the equivalent points value of non-MEM05 units the following factors should be considered:

- the complexity of the skill
- the amount of required knowledge and experience needed
- the amount of on and off the job training required
- the 'size' of the unit in terms of its use in the source qualification
- the relative 'value' of the unit in comparison with other units selected.

Recognition of a person's existing competencies is accommodated through the relevant processes described in the Assessment Guidelines section of this Training Package.

**Qualification titles - additional descriptors**

An additional descriptor may be added to some qualification titles to illustrate a particular skills profile. This may be achieved by the addition of an occupational/functional pathway descriptor after the qualification title as shown on the qualification and/or transcript. This additional descriptor must be drawn from the approved list provided for each qualification and must be shown in brackets. For example, Certificate III in Engineering - Mechanical Trade (Refrigeration and Air-conditioning). There are no specific requirements associated with the use of these descriptors other than their use should reflect the choice of units of competency in the qualification. No other changes may be made to the qualification titles. Note that the addition of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

Reference to other occupational or functional pathways may be included on any qualification statement that is issued. This could be achieved by adding a pathway descriptor or sentence below the formal title of the qualification.

A summary of approved additional descriptors for qualification titles is shown below.

**Summary of approved additional descriptors for qualification titles**

Code	Title	Approved additional descriptors
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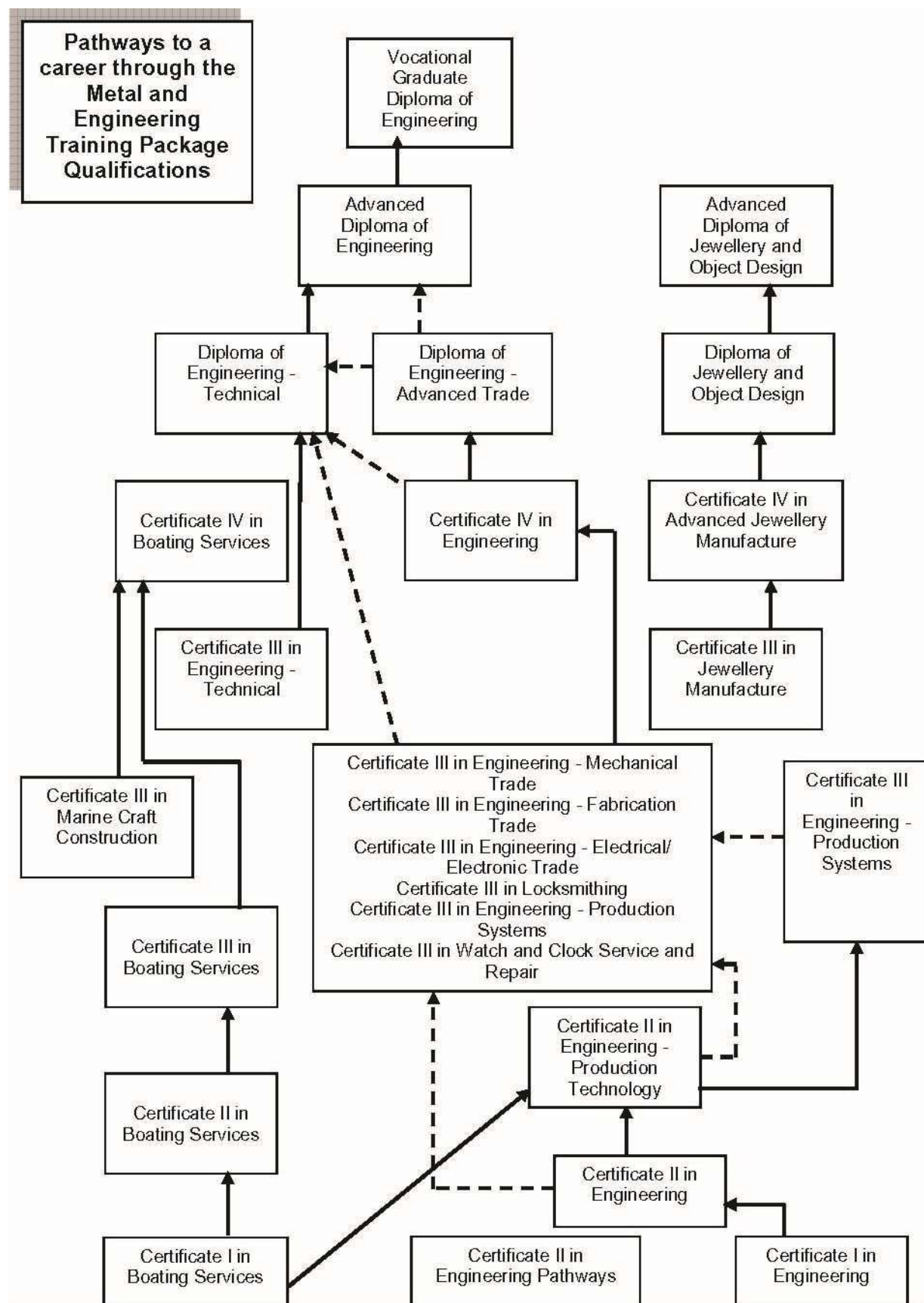
MEM10105	Certificate I in Engineering	There are no approved additional descriptors for this qualification
MEM10205	Certificate I in Boating Services	There are no approved additional descriptors for this qualification
MEM20105	Certificate II in Engineering	Marine craft manufacturing; Surface finishing.
MEM20205	Certificate II in Engineering - Production Technology	Marine craft manufacturing; Surface finishing, Marine Craft Surface Finishing
MEM20305	Certificate II in Boating Services	There are no approved additional descriptors for this qualification
MEM20413	Certificate II in Engineering Pathways	There are no approved additional descriptors for this qualification
MEM30105	Certificate III in Engineering - Production Systems	Surface finishing, Marine Craft Surface Finishing
MEM30205	Certificate III in Engineering - Mechanical Trade	Refrigeration and Air-conditioning; Instrumentation; Maintenance; Patternmaking, Toolmaking; Watchmaking Machining.
MEM30305	Certificate III in Engineering - Fabrication Trade	Casting and Moulding; Heavy Fabrication; Light Fabrication; Maintenance; Patternmaking; Surface Finishing; Welding.
MEM30405	Certificate III in Engineering - Electrical/Electronic Trade	Refrigeration and Air-conditioning; Instrumentation; Maintenance; Marine Electronics.
MEM30505	Certificate III in Engineering - Technical	There are no approved additional descriptors for this qualification
MEM30605	Certificate III in Jewellery Manufacture	There are no approved additional descriptors for this qualification
MEM30705	Certificate III in Marine Craft Construction	There are no approved additional descriptors for this qualification
MEM30805	Certificate III in Locksmithing	There are no approved additional descriptors for this qualification
MEM30905	Certificate III in Boating Services	There are no approved additional

		descriptors for this qualification
MEM31010	Certificate III in Watch and Clock Service and Repair	There are no approved additional descriptors for this qualification
MEM31112	Certificate III in Engineering (Composites Trade)	There are no approved additional descriptors for this qualification
MEM40105	Certificate IV in Engineering	Refrigeration and Air-conditioning; Casting and Moulding; CNC programming; Fluid Power; Heavy Fabrication; Instrumentation; Maintenance; Marine Electronics; Mechatronics; Patternmaking; Robotics; Toolmaking; Welding, Watch and Clock Service and Repair
MEM40205	Certificate IV in Boating Services	There are no approved additional descriptors for this qualification
MEM40311	Certificate IV in Advanced Jewellery Manufacture	There are no approved additional descriptors for this qualification
MEM40412	Certificate IV in Engineering Drafting	There are no approved additional descriptors for this qualification
MEM50105	Diploma of Engineering - Advanced Trade	Refrigeration and Air conditioning; Casting and Moulding; CNC programming; Fluid Power; Heavy Fabrication; Instrumentation; Maintenance; Marine Electronics; Mechatronics; Metrology; Non-Destructive Testing; Patternmaking; Robotics; Toolmaking; Welding, Watch and Clock Service and Repair
MEM50212	Diploma of Engineering - Technical	Mechanical, Mechatronics, Manufacturing, Maintenance, Aeronautical, Avionic
MEM50311	Diploma of Jewellery and Object Design	There are no approved additional descriptors for this qualification
MEM60112	Advanced Diploma of Engineering	Mechanical, Mechatronics, Manufacturing, Maintenance, Aeronautical, Avionic
MEM60211	Advanced Diploma of Jewellery and	There are no approved additional



	Object Design	descriptors for the qualification
MEM80112	Vocational Graduate Diploma of Engineering	There are no approved additional descriptors for the qualification

## MEM05 Qualification Pathways Diagram

**NOTES:**

- The arrows signify normal progression pathways
- All qualifications allow for direct entry
- Most qualifications allow for credit – according to units completed
- Dashed lines are progression pathways between major occupational groupings in the workforce e.g. production to trade or trade to technician. These pathways may require additional training depending on previous electives completed.

## Skill Sets

### Definition

Skill sets are defined as single units of competency, or combinations of units of competency from an endorsed Training Package, which link to a licence or regulatory requirement, or defined industry need.

### Wording on Statements of Attainment

Skill sets are a way of publicly identifying logical groupings of units of competency which meet an identified need or industry outcome. Skill sets are not qualifications.

Where skill sets are identified in a Training Package, the Statement of Attainment can set out the competencies a person has achieved in a way that is consistent and clear for employers and others. This is done by including the wording "these competencies meet [insert skill set title or identified industry area] need" on the Statement of Attainment. This wording applies only to skill sets that are formally identified as such in the endorsed Training Package. See the 2010 edition of the AQF Implementation Handbook for advice on wording on Statements of Attainment. [http://www.aqf.edu.au/Portals/0/Documents/Handbook/AQF\\_Handbook\\_07.pdf](http://www.aqf.edu.au/Portals/0/Documents/Handbook/AQF_Handbook_07.pdf)

### Skill Sets in this Training Package

MEMSS00001      Non Destructive Testing - Level 2 NDT practitioner

## Historical and General Information

### The Metal and Engineering Industry

The various sectors of the metal and engineering industry comprise about 50% of Australia's manufacturing industry in terms of value added share. In general, 85% of these industry sectors are comprised of small to medium enterprises. Each sector is involved in the manufacture, service and repair, and maintenance of products, tooling and equipment, as well as processes.

Engineering installation, repair and maintenance is also applied across most Australian industries. This aspect of applied engineering includes significant numbers of workers. Workforce numbers counted by industry and occupational classifications alone are misleading and unreliable. The current estimate of numbers of workers across Australian industries who are using engineering and manufacturing-engineering skills is approximately 650,000. The majority of these workers are not clearly identified in industry data and many are recorded as workers in other industries such as hospitals, retail etc.

**MEM05v11****Background to development of MEM30413 Certificate II in Engineering Pathways**

The new Certificate II in Engineering Pathways is designed to develop both skills that are essential to seek employment and skills that relate directly to a manufacturing and engineering workplace. This Certificate is intended to provide the student with a set of competencies that collectively open up pathways into employment and/or partial credit towards an apprenticeship.

The new certificate has been developed to apply to a learning and assessment environment where access to structured on the job learning may either not be available or is minimal. It is envisaged that delivery will be supplemented by work placement when available.

The qualification is intended for people interested in exposure to an engineering or related working environment with a view to entering into employment in that area. The learners could be at school or students undertaking the qualification through another registered training organisation. The content has been developed to be fit for purpose, using existing MEM units where considered appropriate and ensuring any gaps are filled with new pathways units.

This certificate is consistent with the AQF level II as defined in the AQF Implementation Handbook. It will ensure that graduates of the course:

- demonstrate basic operational knowledge in a range of engineering tasks in machining, fabrication, assembly and tooling;
- apply basic skills to engineering tasks such as machining, fabrication and assembly;
- apply known solutions and techniques to given standard engineering tasks;
- perform engineering tasks where a choice between a limited number of alternative is required;
- assess and record information in relation to the operation of an engineering workplace; take limited responsibility for their work output and learning.
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**MEM05v9**

The Metal and Engineering Training Package qualifications for engineering technicians and paraprofessionals were first endorsed in 2005, and cover the four engineering disciplines of mechanical, mechatronic, manufacturing and maintenance engineering.

Since endorsement of MEM05 Metal and Engineering Training Package, technology has advanced and it was identified in the MSA Continuous Improvement Plan in 2009 that there was a need to develop new units and update many individual units in the technician/paraprofessional qualifications. As well, MSA received requests to develop units in additional areas of technology, such as rapid manufacturing and heating, ventilation, air conditioning and refrigeration (HVAC/R).

The new units have been included as additional electives, with no change to the packaging rules. All the MEM05 Metal and Engineering Training Package qualifications will be reviewed in 2013 as part of the MEM05 review/streamlining project which commenced August 2012.

In addition to the 73 new technician units, one new unit of competency has been developed in response to an approach from Sutton Tools (Maryborough in Victoria) in conjunction with Bendigo TAFE in 2011, to address the need for a new unit of competency for developing production machining skills for training existing workers in complex machine setting skills. Sutton Tools is one of the world's largest independent family owned cutting tool companies producing high-quality precision cutting tools for the industrial, trade and DIY markets. Sutton Tools is one of three companies chosen to feature in this year's Australian Made, Australian Grown (AMAG) 'Keep Australians Working' campaign. This new unit of competency will typically apply to senior operators undertaking volume production who have responsibility for machine set up to defined parameters, selection of materials and lubricants, establishment of datum points and basic marking out, as well as setting speeds, feeds and other machining parameters. This unit will be a new elective in the MEM20205 Certificate II in Engineering - Production Technology and MEM30105 Certificate III in Engineering - Production Systems and other qualifications requiring production machining skills.

## **MEM05v8**

### **Project background**

Drafting skills are widely used in many industry sectors within engineering and manufacturing and vary from basic entry of information into computer-aided design/drafting (CAD) files to participation in engineering design and the development of highly complex sets of drawings. The growth of CAD has seen a major change in drafting practice as manual drafting skills have become less standard. Most enterprises now use CAD software as the preferred means of generating design or detail drawings.

While the production of detail drawings is important to many sectors with MSA's coverage, for example, furnishing and textiles, clothing and footwear, this project was focused on the occupational outcomes of detail drafter, as well as CAD and drafting skills that are required by occupations covered by the MEM05 Metal and Engineering Training Package. The CAD skills of other industries in MSA's coverage will be addressed in the continuous improvement work being conducted for each sector.

The review and development of CAD skills was undertaken as part of a broader project to review the current MEM Diploma and Advanced Diploma engineering qualifications. This reflects the greater underpinning engineering skills and knowledge required for CAD which makes it less feasible to review design drafting as a separate activity.

The key industry drivers for change include:

- Changes to drafting software and hardware technology and consequent changes to skill application in the development of detail drawings.
- A requirement for more specific detail drawing skills for specialised industry sectors, for example, mechanical services, where current skill and knowledge coverage was not seen to be adequately addressed through more generic CAD units.
- Feedback since the MEM 2005 Review that changes in work roles and technology were leading to difficulty in accessing enough appropriate CAD units to package a well targeted qualification to meet a variety of industry applications.

- Inconsistency of AQF alignment and approach to delivering CAD training across Australia, with both Training Package and state/territory accredited training available at different times in a number of states/territories. In particular, the draft qualifications and units of competency covered by this submission will replace a state accredited course in NSW at the Certificate III level.

## **MEM05v7 Background**

Composites trade certificate

### **Background**

Manufacturing Skills Australia (MSA) were approached in 2009 by Composites Australia (CA), representing the composites sector, as well as the Queensland Department of Employment, Economic Development and Innovation seeking assistance in having the sector gain trade recognition by developing a trade Certificate III for the composites sector.

The composites sector is currently growing in importance as an employer as well as a supplier of fabricated component and products. Its reach goes from marine to aerospace as well as covering a wide range of everyday products. Composites are steadily replacing many traditional materials as well as allowing movement into areas where traditional materials would not be suitable. It is expanding into traditional metal fabrication and construction areas.

The development of a qualification to support a trade required wide national consultation with industry and the industrial parties. MSA contracted Total Training and Performance Solutions (TaPS) to undertake work on this project.

### **Industry drivers for change**

The major industry drivers for the development of this qualification are outlined below:

- Industry and relevant agencies have requested assistance in having the sector gain trade recognition by developing a trade Certificate III for the composites sector.
- This is a sector which is growing and expanding into traditional metal fabrication and construction areas

While there are currently qualifications recognising production skills for this sector, there are no qualifications recognising the need for trade skills. The increasing technical sophistication of this sector is a further justification for the development of a trade qualification.

## **Aluminothemic welding**

### **Background**

Early in 2011 MSA was approached by members of the Hydrocarbons Assessor Network to assist with developing a unit of competency to meet the skills needs of employees and contractors who undertake aluminothemic welding in a field/remote environment.

MSA supported the development of a new unit of competency for this application and commissioned Total Training and Performance Solutions to undertake the work.

### **Industry drivers for change**

The industry reported to MSA that:

- aluminothermic welding is undertaken by process workers and contractors working in this sector
- the only existing unit available is specific to welding of rail and not applicable to this application
- there are safety and environmental issues in undertaking aluminothermic welding in this environment, as well as issues regarding consistency of training and assessment arising from the lack of a relevant endorsed unit of competency.

Industry representatives and RTOs advise that the addition of the new unit of competency to existing MEM qualifications will provide the basis for ensuring adequately skilled workers are undertaking this work, often in remote locations, in a developing sector.

## **MEM05v6 Background**

### **Vocational Graduate Diploma of Engineering**

#### **Project Background**

The project to develop the Vocational Graduate Diploma of Engineering was initiated in response to a request from the Manufacturing and Engineering Skills Advisory Board of Victoria for a Training Package based qualification to replace the current State accredited Advanced Diploma of Engineering - Principal Technical Officer qualification.

The development work for the qualification was undertaken by Richard Jenkins & Associates in conjunction with industry technical advisors. The project was overseen by the MSA MEM Board Sub-Committee. Consultations with industry organisations and Engineers Australia indicated national support for the development of a national qualification that would align to the accepted industry occupation of Principal Technical Officer.

#### **Meeting Industry Needs**

Paraprofessional engineering personnel are employed in many sectors and areas of manufacturing. The major Training Package covering the work of these paraprofessionals in manufacturing industry is the MEM05 Metal and Engineering Training Package. However, this Training Package has not had vocational qualifications aligned to all of the accepted skill levels for paraprofessional work especially those levels requiring a mixture of technical and technical leadership positions. In particular there has not been a national qualification to match the Principal Technical Officer level in industry. This level is recognised in relevant Awards and Agreements, including in some cases, variations of the Principal Technical Officer title. The MEM80111 Vocational Graduate Diploma of Engineering which is now being submitted for endorsement will be the first national qualification to align to the Principal Technical Officer occupation.



The MEM80111 Vocational Graduate Diploma of Engineering also meets the needs of industry for a vocational qualification to align to the internationally accepted designation of Engineering Technologist. This level is recognised through an Accord of Engineering Associations known as the Sydney Accord. The signatory body in Australia is Engineers Australia which has given support for the endorsement of the MEM80111 Vocational Graduate Diploma of Engineering. Engineers Australia has also offered to assist MSA in promoting the MEM80111 Vocational Graduate Diploma of Engineering and in developing promotional and explanatory material.

## **Certificate IV in Advanced Jewellery Manufacture**

### **Project background**

The MEM40311 Certificate IV in Advanced Jewellery Manufacture has been specifically developed to be delivered to people who are existing jewellery tradespersons or delivered to apprentices in a jewellery-related trade who choose to study at a higher level during their apprenticeship. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off the job learning strategies. The qualification may also be achieved through formal skills recognition processes.

### **Meeting industry needs**

The jewellery design and manufacture industry in Australia generates approximately \$889.5 million in revenue, contributing an estimated \$227.1 million to the Australian GDP while employing about 4,191 people. (*IBISWorld Industry Report C2941 Jewellery Manufacturing in Australia, December 2009 Raghu Rajakumar*).

Employees within the industry design and manufacture a range of jewellery and object products, including custom-made, one-off designs, mass produced designs, costume jewellery, mint coins, badges, medals and church ware. Typically workers work with silverware, precious or semi-precious metal and stones. Industry operators may also be involved with designing, manufacturing, engraving, chasing or etching jewellery or precious metal, and selling these products to wholesalers or in certain instances, directly to retailers.

Current coverage within the MEM05 Metal and Engineering Training Package targets the Certificate III trade level outcome which provides the essential technical skills for jewellery manufacturers. This new Certificate IV qualification addresses industry need for more extensive and specialised skills in areas such as engraving and gem setting, and covers skills required to work with a greater range of materials and more complex items. It builds upon trade level skills and encompasses some design units to support a well-rounded outcome for those providing custom-made items.

## **The revised MEM05 Metal and Engineering Training Package**

The MEM05 Metal and Engineering Training Package was developed to replace the MEM98 Metal and Engineering Training Package. The Training Package is designed to meet the training and skills recognition needs of the Australian engineering industry sector. It covers the competencies used by people employed in the manufacturing, engineering and related services industries.

It also provides access to the apprenticeship streams provided by the National Metal and Engineering Industry Competency Standards leading to national qualifications, with traineeship pathways also available. It also enables further career advancement beyond trade apprenticeship and technical traineeship, with progression to Advanced Diploma.

New qualifications for technical workers were added to MEM05 to more accurately reflect the nature of their work. These qualifications make a distinction between technical work and that of tradespersons. In particular, a new Diploma and Advanced Diploma of Engineering were developed to meet the needs of technical workers and para-professionals in the engineering field. For the current Training Package, four disciplines were selected as priority areas. These disciplines are as follows:

- Mechanical
- Mechatronics
- Maintenance
- Manufacturing

Other disciplines will be added to the qualifications over the life of the training package.

There occurred a simplification of some of the qualification titles, as well as changes to the list of qualification descriptors that may be added by RTOs.

The bank of units of competency was revised and extended. Part of the revision included bringing all units to the current approved format. Further information was added to each unit to assist users.

## **Employability Skills**

### **Employability Skills replacing Key Competency information from 2006**

In May 2005, the approach to incorporate Employability Skills within Training Package qualifications and units of competency was endorsed. As a result, from 2006 Employability Skills will progressively replace Key Competency information in Training Packages.

### **Background to Employability Skills**

Employability Skills are also sometimes referred to as generic skills, capabilities or Key Competencies. The Employability Skills discussed here build on the Mayer Committee's Key Competencies, which were developed in 1992 and attempted to describe generic competencies for effective participation in work.

The Business Council of Australia (BCA) and the Australian Chamber of Commerce and Industry (ACCI), produced the *Employability Skills for the Future* report in 2002 in consultation with other peak employer bodies and with funding provided by the Department of Education, Science and Training (DEST) and the Australian National Training Authority (ANTA). Officially released by Dr Nelson (Minister for Education, Science and Training) on 23 May 2002, copies of the report are available from the DEST website at: [http://www.dest.gov.au/archive/ty/publications/employability\\_skills/index.htm](http://www.dest.gov.au/archive/ty/publications/employability_skills/index.htm).

The report indicated that business and industry now require a broader range of skills than the Mayer Key Competencies Framework and featured an Employability Skills Framework identifying eight Employability Skills\*:

- communication
- teamwork
- problem solving
- initiative and enterprise
- planning and organising
- self-management
- learning
- technology.

The report demonstrated how Employability Skills can be further described for particular occupational and industry contexts by sets of facets. The facets listed in the report are the aspects of the Employability Skills that the sample of employers surveyed identified as being important work skills. These facets were seen by employers as being dependent both in their nature and priority on an enterprise's business activity.

\*Personal attributes that contribute to employability were also identified in the report but are not part of the Employability Skills Framework.

### **Employability Skills Framework**

The following table contains the Employability Skills facets identified in the report

*Employability Skills for the Future.*

<b>Skill</b>	<b>Facets</b>  Aspects of the skill that employers identify as important. The nature and application of these facets will vary depending on industry and job type.
<b>Communication</b> that contributes to productive and harmonious relations across employees and customers	<ul style="list-style-type: none"> <li>• listening and understanding</li> <li>• speaking clearly and directly</li> <li>• writing to the needs of the audience</li> <li>• negotiating responsively</li> <li>• reading independently</li> <li>• empathising</li> <li>• using numeracy effectively</li> <li>• understanding the needs of internal and external customers</li> <li>• persuading effectively</li> <li>• establishing and using networks</li> <li>• being assertive</li> <li>• sharing information</li> <li>• speaking and writing in languages other than English</li> </ul>
<b>Teamwork</b> that contributes to productive working relationships and outcomes	<ul style="list-style-type: none"> <li>• working across different ages irrespective of gender, race, religion or political persuasion</li> <li>• working as an individual and as a member of</li> </ul>

	<ul style="list-style-type: none"> <li>a team</li> <li>• knowing how to define a role as part of the team</li> <li>• applying teamwork to a range of situations e.g. futures planning and crisis problem solving</li> <li>• identifying the strengths of team members</li> <li>• coaching and mentoring skills, including giving feedback</li> </ul>
<b>Problem solving</b> that contributes to productive outcomes	<ul style="list-style-type: none"> <li>• developing creative, innovative and practical solutions</li> <li>• showing independence and initiative in identifying and solving problems</li> <li>• solving problems in teams</li> <li>• applying a range of strategies to problem solving</li> <li>• using mathematics, including budgeting and financial management to solve problems</li> <li>• applying problem-solving strategies across a range of areas</li> <li>• testing assumptions, taking into account the context of data and circumstances</li> <li>• resolving customer concerns in relation to complex project issues</li> </ul>
<b>Initiative and enterprise</b> that contribute to innovative outcomes	<ul style="list-style-type: none"> <li>• adapting to new situations</li> <li>• developing a strategic, creative and long-term vision</li> <li>• being creative</li> <li>• identifying opportunities not obvious to others</li> <li>• translating ideas into action</li> <li>• generating a range of options</li> <li>• initiating innovative solutions</li> </ul>
<b>Planning and organising</b> that contribute to long and short-term strategic planning	<ul style="list-style-type: none"> <li>• managing time and priorities - setting time lines, coordinating tasks for self and with others</li> <li>• being resourceful</li> <li>• taking initiative and making decisions</li> <li>• adapting resource allocations to cope with contingencies</li> <li>• establishing clear project goals and deliverables</li> <li>• allocating people and other resources to tasks</li> <li>• planning the use of resources, including time management</li> </ul>

	<ul style="list-style-type: none"> <li>• participating in continuous improvement and planning processes</li> <li>• developing a vision and a proactive plan to accompany it</li> <li>• predicting - weighing up risk, evaluating alternatives and applying evaluation criteria</li> <li>• collecting, analysing and organising information</li> <li>• understanding basic business systems and their relationships</li> </ul>
Self-management that contributes to employee satisfaction and growth	<ul style="list-style-type: none"> <li>• having a personal vision and goals</li> <li>• evaluating and monitoring own performance</li> <li>• having knowledge and confidence in own ideas and visions</li> <li>• articulating own ideas and visions</li> <li>• taking responsibility</li> </ul>
<b>Learning</b> that contributes to ongoing improvement and expansion in employee and company operations and outcomes	<ul style="list-style-type: none"> <li>• managing own learning</li> <li>• contributing to the learning community at the workplace</li> <li>• using a range of mediums to learn - mentoring, peer support and networking, IT and courses</li> <li>• applying learning to technical issues (e.g. learning about products) and people issues (e.g. interpersonal and cultural aspects of work)</li> <li>• having enthusiasm for ongoing learning</li> <li>• being willing to learn in any setting - on and off the job</li> <li>• being open to new ideas and techniques</li> <li>• being prepared to invest time and effort in learning new skills</li> <li>• acknowledging the need to learn in order to accommodate change</li> </ul>
<b>Technology</b> that contributes to the effective carrying out of tasks	<ul style="list-style-type: none"> <li>• having a range of basic IT skills</li> <li>• applying IT as a management tool</li> <li>• using IT to organise data</li> <li>• being willing to learn new IT skills</li> <li>• having the OHS knowledge to apply technology</li> <li>• having the appropriate physical capacity</li> </ul>

## Employability Skills Summary

An Employability Skills Summary exists for each qualification. Summaries provide a lens through which to view Employability Skills at the qualification level and capture the key aspects or facets of the Employability Skills that are important to the job roles covered by the qualification. Summaries are designed to assist trainers and assessors to identify and include important industry application of Employability Skills in learning and assessment strategies.

The following is important information for trainers and assessors about Employability Skills Summaries.

- Employability Skills Summaries provide examples of how each skill is applicable to the job roles covered by the qualification.
- Employability Skills Summaries contain general information about industry context which is further explained as measurable outcomes of performance in the units of competency in each qualification.
- The detail in each Employability Skills Summary will vary depending on the range of job roles covered by the qualification in question.
- Employability Skills Summaries are not exhaustive lists of qualification requirements or checklists of performance (which are separate assessment tools that should be designed by trainers and assessors after analysis at the unit level).
- Employability Skills Summaries contain information that may also assist in building learners' understanding of industry and workplace expectations.
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## Examples from this Training Package of Employability Skills

Unit component	Example of embedded Employability Skill
<b>Unit Title</b>	Manufacture watch and clock components
<b>Unit Descriptor</b>	This unit competency covers manufacturing watch and clock components using a range of general and specialist machines and engineering techniques.
<b>Element</b>	Plan and organise the project
<b>Performance Criteria</b>	Select appropriate equipment and tools to undertake process Plan suitable method of production Undertake measurements to task tolerances
<b>Range Statement</b>	Working drawings may include sketch or illustration by hand, including dimensions  Replacement parts may include wheels and pinions, arbors and pivots, click springs, ratchet wheel, setting lever springs.
<b>Required Skills and Knowledge</b>	Interpreting watch and clock drawings, manuals and other documentation that provide information of part design and tolerances

<b>Unit component</b>	<b>Example of embedded Employability Skill</b>  Performing milling operations using milling attachment on a watch and clockmaker's lathe or a bench mill.  Knowledge of typical materials used in watch and clock making  Selecting and preparing cutting tools.
<b>Evidence Guide</b>	Manufacture, finish and fit replacement watch or clock components to original tolerances.  Select and use appropriate hand tools.

## Assessment Guidelines

### Introduction

These Assessment Guidelines provide the endorsed framework for assessment of units of competency in this Training Package. They are designed to ensure that assessment is consistent with the *Australian Quality Training Framework (AQTF) Essential Standards for Initial and Continuing Registration*. Assessments against the units of competency in this Training Package must be carried out in accordance with these Assessment Guidelines.

### Assessment System Overview

This section provides an overview of the requirements for assessment when using this Training Package, including a summary of the AQTF requirements; licensing/registration requirements; and assessment pathways.

Quality assessment underpins the credibility of the vocational education and training sector. The Assessment Guidelines of a Training Package are an important tool in supporting quality assessment.

Assessment within the National Skills Framework is the process of collecting evidence and making judgements about whether competency has been achieved to confirm whether an individual can perform to the standards expected in the workplace, as expressed in the relevant endorsed unit of competency.

Assessment must be carried out in accordance with the:

- benchmarks for assessment
- specific industry requirements
- principles of assessment
- rules of evidence
- assessment requirements set out in the AQTF.

### Benchmarks for Assessment

The endorsed units of competency in this Training Package are the benchmarks for assessment. As such, they provide the basis for nationally recognised Australian Qualifications Framework (AQF) qualifications and Statements of Attainment issued by Registered Training Organisations (RTOs).

## **Principles of Assessment**

All assessments carried out by RTOs are required to demonstrate compliance with the principles of assessment:

- validity
- reliability
- flexibility
- fairness
- sufficiency

These principles must be addressed in the:

- design, establishment and management of the assessment system for this Training Package
- development of assessment tools
- conduct of assessment.

### *Validity*

Assessment is valid when the process is sound and assesses what it claims to assess. Validity requires that:

- (a) assessment against the units of competency must cover the broad range of skills and knowledge that are essential to competent performance
- (b) assessment of knowledge and skills must be integrated with their practical application
- (c) judgement of competence must be based on sufficient evidence (that is, evidence gathered on a number of occasions and in a range of contexts using different assessment methods). The specific evidence requirements of each unit of competency provide advice on sufficiency

### *Reliability*

Reliability refers to the degree to which evidence presented for assessment is consistently interpreted and results in consistent assessment outcomes. Reliability requires the assessor to have the required competencies in assessment and relevant vocational competencies (or to assess in conjunction with someone who has the vocational competencies). It can only be achieved when assessors share a common interpretation of the assessment requirements of the unit(s) being assessed.



### *Flexibility*

To be flexible, assessment should reflect the candidate's needs; provide for recognition of competencies no matter how, where or when they have been acquired; draw on a range of methods appropriate to the context, competency and the candidate; and support continuous competency development.

### *Fairness*

Fairness in assessment requires consideration of the individual candidate's needs and characteristics, and any reasonable adjustments that need to be applied to take account of them. It requires clear communication between the assessor and the candidate to ensure that the candidate is fully informed about, understands and is able to participate in, the assessment process, and agrees that the process is appropriate. It also includes an opportunity for the person being assessed to challenge the result of the assessment and to be reassessed if necessary.

### *Sufficiency*

Sufficiency relates to the quality and quantity of evidence assessed. It requires collection of enough appropriate evidence to ensure that all aspects of competency have been satisfied and that competency can be demonstrated repeatedly. Supplementary sources of evidence may be necessary. The specific evidence requirements of each unit of competency provide advice on sufficiency. Sufficiency is also one of the rules of evidence.

## **Rules of Evidence**

The rules of evidence guide the collection of evidence that address the principles of validity and reliability, guiding the collection of evidence to ensure that it is valid, sufficient, current and authentic.

### *Valid*

Valid evidence must relate directly to the requirements of the unit of competency. In ensuring evidence is valid, assessors must ensure that the evidence collected supports demonstration of the outcomes and performance requirements of the unit of competency together with the knowledge and skills necessary for competent performance. Valid evidence must encapsulate the breadth and depth of the unit of competency, which will necessitate using a number of different assessment methods.

### *Sufficient*

Sufficiency relates to the quality and quantity of evidence assessed. It requires collection of enough appropriate evidence to ensure that all aspects of competency have been satisfied and that competency can be demonstrated repeatedly. Supplementary sources of evidence may be necessary. The specific evidence requirements of each unit of competency provide advice on sufficiency.

### *Current*

In assessment, currency relates to the age of the evidence presented by a candidate to demonstrate that they are still competent. Competency requires demonstration of current performance, so the evidence collected must be from either the present or the very recent past.

### *Authentic*

To accept evidence as authentic, an assessor must be assured that the evidence presented for assessment is the candidate's own work.

## **Assessment Requirements of the Australian Quality Training Framework**

Assessment leading to nationally recognised AQF qualifications and Statements of Attainment in the vocational education and training sector must meet the requirements of the AQTF as expressed in the AQTF 2010 *Essential Standards for Registration*.

The AQTF 2010 *Essential Standards for Initial and Continuing Registration* can be downloaded from < [www.training.com.au](http://www.training.com.au) >.

The following points summarise the assessment requirements.

## **Registration of Training Organisations**

Assessment must be conducted by, or on behalf of, an RTO formally registered by a State or Territory Registering Body in accordance with the AQTF. The RTO must have the specific units of competency and/or AQF qualifications on its scope of registration.

## **Quality Training and Assessment**

Each RTO must provide quality training and assessment across all its operations. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*, Standard 1.

## **Assessor Competency Requirements**

Each person involved in training, assessment or client service must be competent for the functions they perform. AQTF 2010 *Essential Standards for Initial and Continuing Registration*, Standard 1 for assessor (and trainer) competency requirements. See also the AQTF 2010 *Users Guide to the Essential Standards for Registration* Appendix 2.

## **Assessment Requirements**

The RTOs assessments, including RPL, must meet the requirements of the relevant endorsed Training Package. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

## **Assessment Strategies**

Each RTO must have strategies for training and assessment that meet the requirements of the relevant Training Package or accredited course and are developed in consultation with industry stakeholders. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **National Recognition**

Each RTO must recognise the AQF qualifications and Statements of Attainment issued by any other RTO. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **Access and Equity and Client Outcomes**

Each RTO must adhere to the principles of access and equity and maximise outcomes for its clients. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **Monitoring Assessments**

Training and/or assessment provided on behalf of the RTO must be monitored to ensure that it is in accordance with all aspects of the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **Recording Assessment Outcomes**

Each RTO must manage records to ensure their accuracy and integrity. See the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

### **Issuing AQF Qualifications and Statements of Attainment**

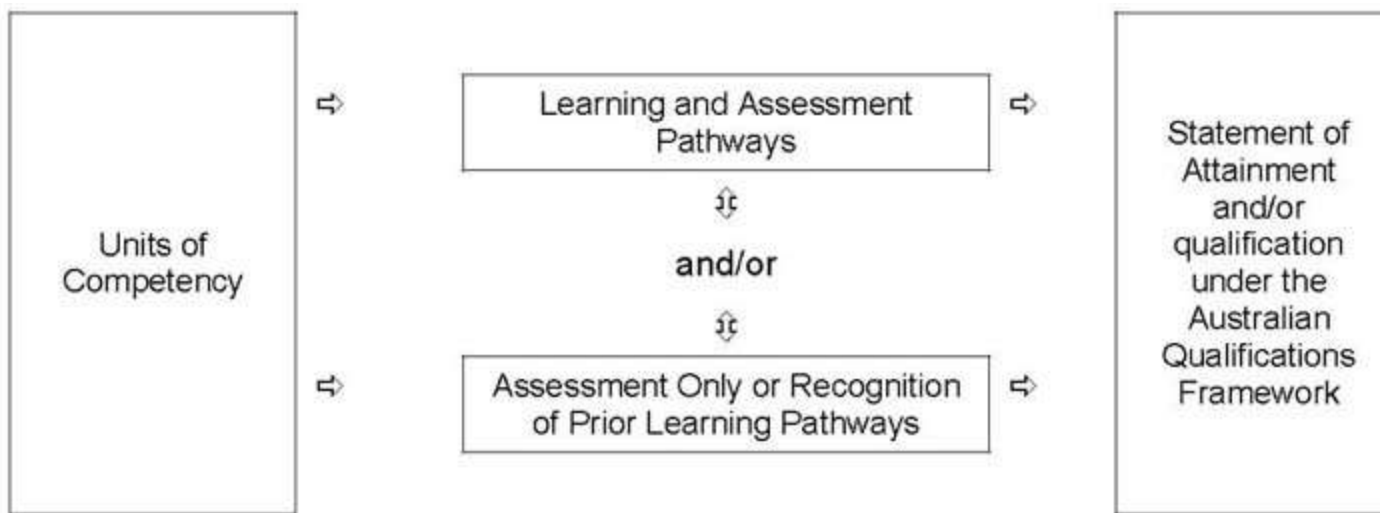
Each RTO must issue AQF qualifications and Statements of Attainment that meet the requirements of the current AQF Implementation Handbook and the endorsed Training Packages within the scope of its registration. An AQF qualification is issued once the full requirements for a qualification, as specified in the nationally endorsed Training Package are met. A Statement of Attainment is issued when an individual has completed one or more units of competency from nationally recognised qualification(s)/courses(s). See the AQTF and the edition of the AQF Implementation Handbook-available on the AQF Council website < [www.aqf.edu.au](http://www.aqf.edu.au)>.

### **Pathways**

The competencies in this Training Package may be attained in a number of ways including through:

- formal or informal education and training
- experiences in the workplace
- general life experience, and/or
- any combination of the above.

Assessment under this Training Package leading to an AQF qualification or Statement of Attainment may follow a learning and assessment pathway, an assessment-only or recognition pathway, or a combination of the two as illustrated in the following diagram.



Each of these assessment pathways leads to full recognition of competencies held - the critical issue is that the candidate is competent, not how the competency was acquired.

Assessment, by any pathway, must comply with the assessment requirements set out in the Assessment Guidelines of the Training Package, and the AQTF, where relevant, the Australian Qualifications Framework.

### Learning and Assessment Pathways

Usually, learning and assessment are integrated, with assessment evidence being collected and feedback provided to the candidate at any time throughout the learning and assessment process.

Learning and assessment pathways may include structured programs in a variety of contexts using a range of strategies to meet different learner needs. Structured learning and assessment programs could be: group-based, work-based, project-based, self-paced, action learning-based; conducted by distance or e-learning; and/or involve practice and experience in the workplace.

Learning and assessment pathways to suit Australian Apprenticeships have a mix of formal structured training and structured workplace experience with formative assessment activities through which candidates can acquire and demonstrate skills and knowledge from the relevant units of competency.

### Credit Pathways

*Credit* is the value assigned for the recognition of equivalence in content between different types of learning and/or qualifications which reduces the volume of learning required to achieve a qualification.

Credit arrangements must be offered by all RTOs that offer Training Package qualifications. Each RTO must have a systematic institutional approach with clear, accessible and transparent policies and procedures.

Competencies already held by individuals can be formally assessed against the units of competency in this Training Package, and should be recognised regardless of how, when or where they were acquired, provided that the learning is relevant to the unit of competency outcomes.

## Recognition of Prior Learning

Recognition of Prior Learning (RPL) is an assessment process which determines the credit outcomes of an individual application for credit.

The availability of RPL provides all potential learners with access to credit opportunities.

The recognition of prior learning pathway is appropriate for candidates who have previously attained skills and knowledge and who, when enrolling in qualifications, seek to shorten the duration of their training and either continue or commence working. This may include the following groups of people:

existing workers; individuals with overseas qualifications; recent migrants with established work histories; people returning to the workplace; and people with disabilities or injuries requiring a change in career.

As with all assessment, RPL assessment should be undertaken by academic or teaching staff with expertise in the subject, content of skills area, as well as knowledge of and expertise in RPL assessment policies and procedures.

Assessment methods used for RPL should provide a range of ways for individuals to demonstrate that they have met the required outcomes and can be granted credit. These might include:

- questioning (oral or written) consideration of a portfolio and review of contents consideration of third party reports and/or other documentation such as documentation such as articles, reports, project material, papers, testimonials or other products prepared by the RPL applicant that relate to the learning outcomes of the relevant qualification component mapping of learning outcomes from prior formal or non-formal learning to the relevant qualification components
- observation of performance, and participation in structured assessment activities the individual would normally be required to undertake if they were enrolled in the qualification component/s.

In a RPL pathway, the candidate provides current, quality evidence of their competency against the relevant unit of competency. This process may be directed by the candidate and verified by the assessor. Where the outcomes of this process indicate that the candidate is competent, structured training is not required. The RPL requirements of the AQTF must be met.

As with all assessment, the assessor must be confident that the evidence indicates that the candidate is currently competent against the endorsed unit of competency. This evidence may take a variety of forms and might include certification, references from past employers, testimonials from clients, work samples and/or observation of the candidate. The onus is on candidates to provide sufficient evidence to satisfy assessors that they currently hold the relevant competencies. In judging evidence, the assessor must ensure that the evidence of prior learning is:

- authentic (the candidate's own work);
- valid (directly related to the current version of the relevant endorsed unit of competency);
- reliable (shows that the candidate consistently meets the endorsed unit of competency);
- current (reflects the candidate's current capacity to perform the aspect of the work covered by the endorsed unit of competency); and
- sufficient (covers the full range of elements in the relevant unit of competency and addresses the four dimensions of competency, namely task skills, task management skills, contingency management skills, and job/role environment skills).

## Credit Transfer

*Credit transfer is a process which provides learners with agreed and consistent credit outcomes based on equivalences in content between matched qualifications.*

This process involves education institutions:

- mapping, comparing and evaluating the extent to which the defined learning outcomes and assessment requirements of the individual components of one qualification are equivalent to the learning outcomes and assessment requirements of the individual components of another qualification
- making an educational judgment of the credit outcomes to be assigned between the matched components of the two qualifications
- setting out the agreed credit outcomes in a documented arrangement or agreement, and publicising the arrangement/agreement and credit available.

## Combination of Pathways

Credit may be awarded on the basis of a combination of credit transfer plus an individual RPL assessment for additional learning. Once credit has been awarded on the basis of RPL, subsequent credit transfer based on these learning outcomes should not include revisiting the RPL assessment but should be based on credit transfer or articulation or other arrangements between providers.

Where candidates for assessment have gained competencies through work and life experience and gaps in their competence are identified, or where they require training in new areas, a combination of pathways may be appropriate.

In such situations, the candidate may undertake an initial assessment to determine their current competency. Once current competency is identified, a structured learning and assessment program ensures that the candidate acquires the required additional competencies identified as gaps.

## Assessor Requirements

This section identifies the specific requirements on the vocational competence and experience for assessors, to ensure that they meet the needs of industry and their obligations under AQTF, and clarifies how others may contribute to the assessment process where one person alone does not hold all the required competencies.

## Assessor Competencies

The AQTF specifies mandatory competency requirements for assessors. For information, Element 1.4 from the AQTF 2007 *Essential Standards for Registration* follows:

1.4 Training and assessment is delivered by trainers and assessors who:

- a) have the necessary training and assessment competencies as determined by the National Quality Council or its successors, and
- b) have the relevant vocational competencies at least to the level being delivered or assessed, and
- c) can demonstrate current industry skills directly relevant to the training/assessment being undertaken, and
- d) continue developing their Vocational Education and Training (VET) knowledge and skills as well as their industry currency and trainer/assessor competence.

\* See AQTF 2010 *Users Guide to the Essential Standards for Registration* Appendix 2

## Designing Assessment Tools

This section provides an overview on the use and development of assessment tools.

### Use of Assessment Tools

Assessment tools provide a means of collecting the evidence that assessors use in making judgments about whether candidates have achieved competency.

There is no set format or process for the design, production or development of assessment tools. Assessors may use prepared assessment tools, such as those specifically developed to support this Training Package, or they may develop their own.

### Using Prepared Assessment Tools

If using prepared assessment tools, assessors should ensure these relate to the current version of the relevant unit of competency. The current unit of competency can be checked on the National Register < [www.training.gov.au](http://www.training.gov.au) >.

### Developing Assessment Tools

When developing assessment tools, assessors must ensure that they:

- are benchmarked against the relevant unit or units of competency
- are reviewed as part of the continuous improvement of assessment strategies as required under Standard 1 of the AQTF 2007
- meet the assessment requirements expressed in Standard 1 of the AQTF 2010 *Essential Standards for Initial and Continuing Registration*.

A key reference for assessors developing assessment tools is TAE10 Training and Education Training Package.

### **Language, Literacy and Numeracy**

The design of assessment tools must reflect the language, literacy and numeracy competencies required for the performance of a task in the workplace and not exceed these expectations.

### **Conducting Assessment**

This section details the mandatory assessment requirements and provides information on equity in assessment including reasonable adjustment.

### **Mandatory Assessment Requirements**

Assessments must meet the criteria set out in the 2010 *Essential Standards for Initial and Continuing Registration*. For information, the mandatory assessment requirements from Standard 1 from the AQTF 2010 *Essential Standards for Initial and Continuing Registration* are as follows:

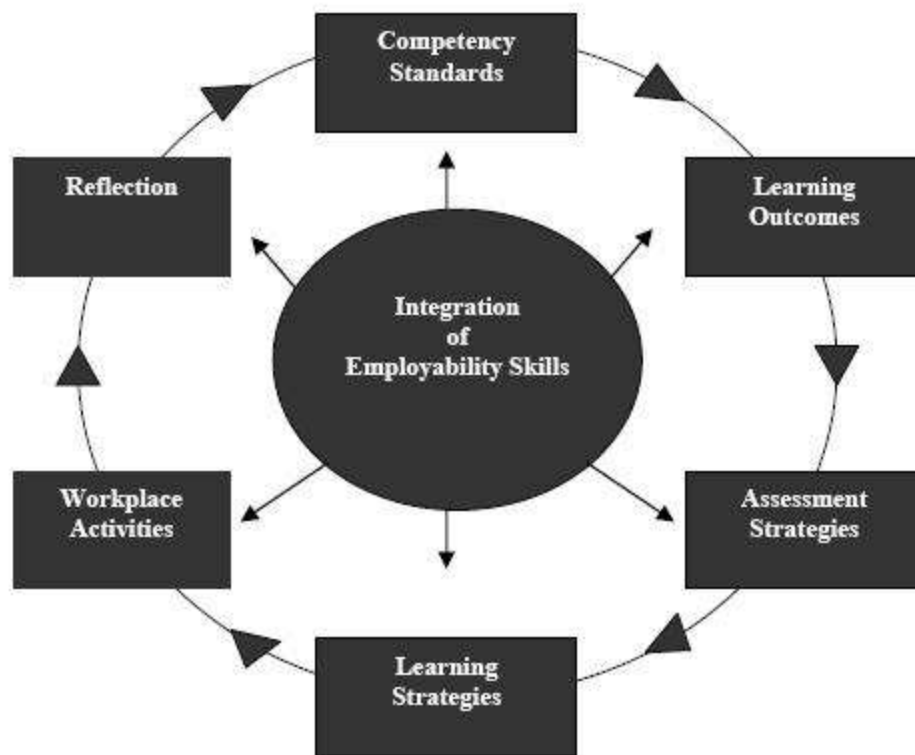
#### **1.5 Assessment, including Recognition of Prior Learning:**

- a) meets the requirements of the relevant Training Package or accredited course,
- b) is conducted in accordance with the principles of assessment and the rules of evidence, and
- c) meets workplace and, where relevant, regulatory requirements.
- d) is systematically validated.

### **Assessment of Employability Skills**

Employability Skills are integral to workplace competency. As such they must be considered in the design, customisation, delivery and assessment of vocational education and training programs in an integrated and holistic way, as represented diagrammatically below.





Employability Skills are embedded and explicit within each unit of competency, and an Employability Skills Summary is available for each qualification. Training providers must use Employability Skills information in order to design valid and reliable training and assessment strategies. This analysis could include:

- reviewing units of competency to locate relevant Employability Skills and determine how they are applied within the unit
- analysing the Employability Skills Summary for the qualification in which the unit or units are packaged to help clarify relevant industry and workplace contexts and the
- application of Employability Skills at that qualification outcome
- designing training and assessment to address Employability Skills requirements.

The National Quality Council has endorsed a model for assessing and reporting Employability Skills, which contains further suggestions about good practice strategies in teaching, assessing, learning and reporting Employability Skills. The model is available from < <http://www.training.com.au/>>.

The endorsed approach includes learners downloading qualification specific Employability Skills Summaries for Training Package qualifications from an online repository at < <http://employabilityskills.training.com.au>>

For more information on Employability Skills in Manufacturing Industry Skills Council Training Packages go to the Manufacturing Industry Skills Council website at <http://www.mskills.com.au>.

Employability Skills are reported on each qualification using the following statement on the qualification testamur: "A summary of the Employability Skills developed through this qualification can be downloaded from <http://employabilityskills.training.com.au> "

### **Access and Equity**

An individual's access to the assessment process should not be adversely affected by restrictions placed on the location or context of assessment beyond the requirements specified in this Training Package: training and assessment must be bias-free.

Under the rules for their development, Training Packages must reflect and cater for the increasing diversity of Australia's VET clients and Australia's current and future workforce. The flexibilities offered by Training Packages should enhance opportunities and potential outcomes for all people so that we can all benefit from a wider national skills base and a shared contribution to Australia's economic development and social and cultural life.

### **Reasonable adjustments**

It is important that education providers take meaningful, transparent and reasonable steps to consult, consider and implement reasonable adjustments for students with disability.

Under the *Disability Standards for Education 2005*, education providers must make reasonable adjustments for people with disability to the maximum extent that those adjustments do not cause that provider unjustifiable hardship. While "reasonable adjustment" and "unjustifiable hardship" are different concepts and involve different considerations, they both seek to strike a balance between the interests of education providers and the interests of students with and without disability.

An adjustment is any measure or action that a student requires because of their disability, and which has the effect of assisting the student to access and participate in education and training on the same basis as students without a disability. An adjustment is reasonable if it achieves this purpose while taking into account factors such as the nature of the student's disability, the views of the student, the potential effect of the adjustment on the student and others who might be affected, and the costs and benefits of making the adjustment.

An education provider is also entitled to maintain the academic integrity of a course or program and to consider the requirements or components that are inherent or essential to its nature when assessing whether an adjustment is reasonable. There may be more than one adjustment that is reasonable in a given set of circumstances; education providers are required to make adjustments that are reasonable and that do not cause them unjustifiable hardship.

The Training Package Guidelines provides more information on reasonable adjustment, including examples of adjustments. Go to <http://www.deewr.gov.au/tpdh/Pages/home.aspx>.

### **Further Sources of Information**

The section provides a listing of useful contacts and resources to assist assessors in planning, designing, conducting and reviewing of assessments against this Training Package.

#### **Contacts**

Manufacturing Skills Australia

#### **Street Address**

Level 3, 104 Mount Street  
North Sydney NSW 2060

**Postal Address :**

PO Box 289  
North Sydney NSW 2059  
Ph: +612 9955 5500  
Fax: +612 9955 8044  
Email: [info@mskills.com.au](mailto:info@mskills.com.au)  
Web: [www.mskills.com.au](http://www.mskills.com.au)

For information on the TAE10 Training and Education Training Package contact:

Innovation & Business Skills Australia

Telephone: (03) 9815 7000

Facsimile: (03) 9815 7001

Email: [virtual@ibsa.org.au](mailto:virtual@ibsa.org.au)

Web: [www.ibsa.org.au](http://www.ibsa.org.au)

**General Resources**

AQF Implementation Handbook, Fourth Edition 2007. Australian Qualifications Framework Advisory Board, 2002 < [www.aqf.edu.au](http://www.aqf.edu.au) >

Australian Quality Training Framework (AQTF) and AQTF 2010 Users" Guide to the Essential Standards for Registration  
<http://www.training.com.au/pages/menuitem5cbe14d51b49dd34b225261017a62dbc.aspx>

For general information and resources go to <http://www.training.com.au/>

The National Register is an electronic database providing comprehensive information about RTOs, Training Packages and accredited courses - < [www.training.gov.au](http://www.training.gov.au) >

The Training Package Development Handbook site provides National Quality Council policy for the development of Training Packages. The site also provides guidance material for the application of that policy, and other useful information and links.

<http://www.deewr.gov.au/Skills/Overview/Policy/TPDH/Pages/main.aspx>

**Assessment Resources**

Registered training organisations (RTOs) are at the forefront of vocational education and training (VET) in Australia. They translate the needs of industry into relevant, quality, client-focussed training and assessment.

RTOs should strive for innovation in VET teaching and learning practices and develop highly flexible approaches to assessment which take cognisance of specific needs of learners, in order to improve delivery and outcomes of training.

Resources can be purchased or accessed from TVET Australia provides an integrated service to enable users of the national training system to identify and acquire training materials, identify copyright requirements and enter licenses for use of that material consistent with the scope and direction of the NQC. <http://www.productservices.tvetaustralia.com.au/>

## **MEM05 Assessment Advice**

It is important that assessors are familiar with the use of the Metal and Engineering Competency Standards and the agreed industrial processes for their implementation in workplaces. Manufacturing Skills Australia can provide a list of approved organisations that provide an Implementing Competency Standards Program that will assist assessors.

### **Advice on integrated assessment**

The Metal and Engineering Training Package is comprised of units of competency that will rarely be used in isolation. All units will form part of a person's job role. No single unit of competency can be acquired in isolation and therefore opportunities for integrated learning and assessment activities should always be explored. Careful consideration of the profile of competencies will identify groups of units where integrated assessment (or co-assessment) can be applied.

Adoption of integrated assessment can provide significant savings in time, cost and effort of assessors and candidates. Assessment tools should be designed so that assessment evidence can be gathered for a group of units and the outcomes identified with those units. This approach can be quite adequately used to also deal with prerequisites.

### **Advice on assessment of Prerequisite Units**

The Metal and Engineering Training Package units of competency are built on a structure of accumulated skills and knowledge. This means that there are hierarchies of skills and knowledge that are built up from a range of competencies. Any units of competency that underpin others are listed as prerequisites.

The use of the term 'prerequisite' has been used for many years in the Metal and Engineering units of competency. In terms of training delivery and assessment, the term 'prerequisite' means that a person cannot be deemed 'competent' in the higher level unit until they are deemed competent in the prerequisite units. An RTO may choose an integrated assessment approach (see above). In this case the actual assessment of prerequisites may occur concurrently with other units.

## MEM05 Licensing requirements

Specific licenses may be required in some jobs. The local regulations should be checked for details. The industry is generally subject to a range of regulatory control. These vary with the nature of the work and to some extent on its location as most regulations are State based and some are enforced by local government. This Training Package allows for these differences without mandating them to specific units of competency which would not be appropriate.

Selected units of competency and qualifications in this Training Package have been designed to satisfy or partly satisfy the licensing requirements of various industry sectors.

This Metal and Engineering Training Package publication provides advisory information based on discussions with representatives of industry and regulators. All possible care has been taken in the preparation of this material, however, persons should not rely solely on this publication on matters involving industry specific current or proposed licensing requirements or arrangements.

## Competency Standards

### What is competency?

The broad concept of industry competency concerns the ability to perform particular tasks and duties to the standard of performance expected in the workplace. Competency requires the application of specified skills, knowledge and attitudes relevant to effective participation in an industry, industry sector or enterprise.

Competency covers all aspects of workplace performance and involves performing individual tasks; managing a range of different tasks; responding to contingencies or breakdowns; and, dealing with the responsibilities of the workplace, including working with others. Workplace competency requires the ability to apply relevant skills, knowledge and attitudes consistently over time and in the required workplace situations and environments. In line with this concept of competency Training Packages focus on what is expected of a competent individual in the workplace as an outcome of learning, rather than focussing on the learning process itself.

Competency standards in Training Packages are determined by industry to meet identified industry skill needs. Competency standards are made up of a number of units of competency each of which describes a key function or role in a particular job function or occupation. Each unit of competency within a Training Package is linked to one or more AQF qualifications.

### Contextualisation of Units of Competency by RTOs

Registered Training Organisation (RTOs) may contextualise units of competency to reflect local outcomes required. Contextualisation could involve additions or amendments to the unit of competency to suit particular delivery methods, learner profiles, specific enterprise equipment requirements, or to otherwise meet local needs. However, the integrity of the overall intended outcome of the unit of competency must be maintained.

Any contextualisation of units of competency in this endorsed Training Package must be within the bounds of the following advice. In contextualising units of competency, RTOs:

- must not remove or add to the number and content of elements and performance criteria
- may add specific industry terminology to performance criteria where this does not distort or narrow the competency outcomes
- may make amendments and additions to the range statement as long as such changes do not diminish the breadth of application of the competency and reduce its portability, and/or
- may add detail to the evidence guide in areas such as the critical aspects of evidence or resources and infrastructure required where these expand the breadth of the competency but do not limit its use.

### **Components of Units of Competency**

The components of units of competency are summarised below, in the order in which they appear in each unit of competency.

#### **Unit Title**

The unit title is a succinct statement of the outcome of the unit of competency. Each unit of competency title is unique, both within and across Training Packages.

#### **Unit Descriptor**

The unit descriptor broadly communicates the content of the unit of competency and the skill area it addresses. Where units of competency have been contextualised from units of competency from other endorsed Training Packages, summary information is provided. There may also be a brief second paragraph that describes its relationship with other units of competency, and any licensing requirements.

#### **Employability Skills statement**

A standard Employability Skills statement appears in each unit of competency. This statement directs trainers and assessors to consider the information contained in the Employability Skills Summary in which the unit of competency is packaged.

#### **Prerequisite Units (optional)**

If there are any units of competency that must be completed before the unit, these will be listed.

#### **Application of the Unit**

This sub-section fleshes out the unit of competency's scope, purpose and operation in different contexts, for example, by showing how it applies in the workplace.

#### **Competency Field (Optional)**

The competency field either reflects the way the units of competency are categorised in the Training Package or denotes the industry sector, specialisation or function. It is an optional component of the unit of competency.

#### **Sector (optional)**

The industry sector is a further categorisation of the competency field and identifies the next classification, for example an elective or supervision field.

#### **Elements of Competency**

The elements of competency are the basic building blocks of the unit of competency. They describe in terms of outcomes the significant functions and tasks that make up the competency.

### **Performance Criteria**

The performance criteria specify the required performance in relevant tasks, roles, skills and in the applied knowledge that enables competent performance. They are usually written in passive voice. Critical terms or phrases may be written in bold italics and then defined in range statement, in the order of their appearance in the performance criteria.

### **Required Skills and Knowledge**

The essential skills and knowledge are either identified separately or combined. Knowledge identifies what a person needs to know to perform the work in an informed and effective manner. Skills describe the application of knowledge to situations where understanding is converted into a workplace outcome.

### **Range Statement**

The range statement provides a context for the unit of competency, describing essential operating conditions that may be present with training and assessment, depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts. As applicable, the meanings of key terms used in the performance criteria will also be explained in the range statement.

### **Evidence Guide**

The evidence guide is critical in assessment as it provides information to the Registered Training Organisation (RTO) and assessor about how the described competency may be demonstrated. The evidence guide does this by providing a range of evidence for the assessor to make determinations, and by providing the assessment context. The evidence guide describes:

- conditions under which competency must be assessed including variables such as the assessment environment or necessary equipment
- relationships with the assessment of any other units of competency
- suitable methodologies for conducting assessment including the potential for workplace simulation
- resource implications, for example access to particular equipment, infrastructure or situations
- how consistency in performance can be assessed over time, various contexts and with a range of evidence, and expectations at the AQF qualification level involved

### **Employability Skills in units of competency**

The detail and application of Employability Skills facets will vary according to the job-role requirements of each industry. In developing Training Packages, industry stakeholders are consulted to identify appropriate facets of Employability Skills which are incorporated into the relevant units of competency and qualifications.

Employability Skills are not a discrete requirement contained in units of competency (as was the case with Key Competencies). Employability Skills are specifically expressed in the context of the work outcomes described in units of competency and will appear in elements, performance criteria, range statements and evidence guides. As a result, users of Training Packages are required to review the entire unit of competency in order to accurately determine Employability Skills requirements.

### How Employability Skills relate to the Key Competencies

The eight nationally agreed Employability Skills now replace the seven Key Competencies in Training Packages. Trainers and assessors who have used Training Packages prior to the introduction of Employability Skills may find the following comparison useful.

Employability Skills	Key Competencies
Communication	Communicating ideas and information
Teamwork	Working with others and in teams
Problem solving	Solving problems Using mathematical ideas and techniques
Initiative and enterprise	
Planning and organising	Collecting, analysing and organising information Planning and organising activities
Self-management	
Learning	
Technology	Using technology

When analysing the above table it is important to consider the relationship and natural overlap of Employability Skills. For example, using technology may involve communication skills and combine the understanding of mathematical concepts.

### Explicitly embedding Employability Skills in units of competency

This Training Package seeks to ensure that industry-endorsed Employability Skills are explicitly embedded in units of competency. The application of each skill and the level of detail included in each part of the unit will vary according to industry requirements and the nature of the unit of competency.

Employability Skills must be both explicit and embedded within units of competency. This means that Employability Skills will be:

- embedded in units of competency as part of the other performance requirements that make up the competency as a whole



- explicitly described within units of competency to enable Training Packages users to identify accurately the performance requirements of each unit with regards to Employability Skills.

This Training Package also seeks to ensure that Employability Skills are well-defined and written into units of competency so that they are apparent, clear and can be delivered and assessed as an essential component of unit work outcomes.

The following table contains examples of embedded Employability Skills for each component of a unit of competency. Please note that in the examples below the bracketed skills are provided only for clarification and will not be present in units of competency within this Training Package.

### Example Employability Skills unit

Unit component	Example of embedded Employability Skill
<b>Unit Title</b>	Manufacture watch and clock components
<b>Unit Descriptor</b>	This unit competency covers manufacturing watch and clock components using a range of general and specialist machines and engineering techniques.
<b>Element</b>	Plan and organise the project
<b>Performance Criteria</b>	Select appropriate equipment and tools to undertake process Plan suitable method of production Undertake measurements to task tolerances
<b>Range Statement</b>	Working drawings may include sketch or illustration by hand, including dimensions Replacement parts may include wheels and pinions, arbors and pivots, click springs, ratchet wheel, setting lever springs.
<b>Required Skills and Knowledge</b>	Interpreting watch and clock drawings, manuals and other documentation that provide information of part design and tolerances Performing milling operations using milling attachment on a watch and clockmaker's lathe or a bench mill.
	Knowledge of typical materials used in watch and clock making Selecting and preparing cutting tools.
<b>Evidence Guide</b>	Manufacture, finish and fit replacement watch or clock components to original tolerances. Select and use appropriate hand tools.

## Competency Standards - MEM05 Industry Contextualisation

### Prerequisite Units and Prerequisite Pathways – MEM05

The Metal and Engineering Training Package units of competency are built on a structure of accumulated skills and knowledge. This means that there are hierarchies of skills and knowledge that are built up from a range of competencies. This may have an impact on training and assessment delivery strategies.

Any units of competency that underpin others are listed as prerequisites. In some cases there are options within the prerequisites. These combinations reflect the fact that different "skill paths" may be taken to reach a unit of competency. Where multiple paths (path 1, path 2, etc.) are shown, then the most appropriate path should be chosen. Unless indicated otherwise, the prerequisite units should be counted in the total number of units (and points) that contribute towards the qualification.

### Competency Field

The competency standards are divided into 'fields' as convenient groupings of units to assist the organisation of the standards and to help users in the selection of relevant competency standards. The fields do not set up barriers to accessing any competency units in a field, or between fields.

### Application of the Competency

This sub-section describes more of the unit of competency's scope and limitation as well as purpose and operation in different contexts, for example, by showing how it applies in the workplace.

### Related units

This section provides an indication of other units that may also be required in particular circumstances as well as indications of alternatives.

### Band

Many of the units of competency are also divided into 'bands', with some overlap between them. The allocation of units to different bands recognises the inherent differences in the level of difficulty of skills used in the industry. For example, band B skills are more difficult than band A skills. At the same time the large range of units in each band allows enterprises a wide choice. Band E units are independent units developed for the boating services qualifications.

Some units are regarded as both band A and band B units. Use of these dual band units is limited. These units are identified in the units themselves by way of a note.

## Unit Weight

Many units of competency have an allocated weight shown as 'unit weight'. This weighting is usually referred to as 'points'. These points weightings are used in the packaging rules for some of the qualifications. The units selected for the qualification must have a combined points value no less than the points value specified for the various components of the qualification. These combined points totals also include the points for any prerequisite units involved.

Note that the points for any particular unit can only be counted once in each qualification. For example, if a unit is selected to be part of a qualification and it is also a prerequisite for another selected unit, then the points for that unit can only be counted once.

## Notes

Special notes are included in some units, for example, where the unit is a dual band unit.

## Appendix 1: MEM05 Units, prerequisites, points and weighting

Not applicable.

## 0300 Assembly

Unit code	Unit title	P
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MEM03001B	Perform manual production assembly	4
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MEM03002B	Perform precision assembly	4
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### Path: 1 Total Path Weight:6

MEM18001	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM03004B	Perform electronic/electrical assembly (production)	8
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MEM03005B	Rework and repair (electrical/electronic production)	8
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### Path: 1 Total Path Weight: 22

MEM03004B	Perform electronic/electrical assembly (production)	8
MEM05001B	Perform manual soldering/desoldering – electrical/ electronic components	4
MEM18001C	Use hand tools	2

MEM03006B	Set assembly stations	2
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**Path: 1 Total Path Weight: 8**

MEM03001B	Perform manual production assembly	4
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 10**

MEM03003B	Perform sheet and plate assembly	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 3 Total Path Weight: 12**

MEM03004B	Perform electronic/electrical assembly (production)	8
MEM18001C	Use hand tools	2

## 0400 Casting and moulding

Unit code	Unit title	P
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MEM04001B	Operate melting furnaces	4
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**Path: 1 Total Path Weight: 6**

MEM13004B	Work safely with molten metals/glass	2
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MEM04002B	Perform gravity die casting	2
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**Path: 1 Total Path Weight: 4**

MEM13004B	Work safely with molten metals/glass	2
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MEM04003B	Operate pressure die casting machine	4
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**Path: 1 Total Path Weight: 6**

MEM13004B	Work safely with molten metals/glass	2
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MEM04004B	Prepare and mix sand for metal moulding	4
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MEM04005C	Produce moulds and cores by hand (jobbing)	16
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**Path: 1 Total Path Weight: 22**

MEM09002B	Interpret technical drawing	4
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MEM18001C	Use hand tools	2
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MEM04006B	Operate sand moulding and core making machines	8
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MEM04007B	Pour molten metal	4
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**Path: 1 Total Path Weight**

MEM13004B	Work safely with molten metals/glass	2
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MEM04008B	Fettle and trim metal castings/forgings	4
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**Path: 1 Total Path Weight: 8**

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM04010B	Develop and manufacture wood patterns	20
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**Path: 1 Total Path Weight: 48**

MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04011B	Produce polymer patterns	8
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**Path: 1 Total Path Weight: 29**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

MEM04012B	Assemble plated patterns	8
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**Path: 1 Total Path Weight: 56**

MEM04010B	Develop and manufacture wood patterns	20
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MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04013B	Develop and manufacture polystyrene patterns	2
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**Path: 1 Total Path Weight: 50**

MEM04010B	Develop and manufacture wood patterns	20
MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04014B	Develop and manufacture production patterns	8
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**Path: 1 Total Path Weight: 72**

MEM04010B	Develop and manufacture wood patterns	20
MEM04012B	Assemble plated patterns	8
MEM04018B	Perform general woodworking machine operations	4
MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
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**Path: 1 Total Path Weight: 72**

MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04018B	Perform general woodworking machine operations	4
MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3



MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04016C	Develop and manufacture precision models	6
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**Path: 1 Total Path Weight: 98**

MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2
MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04018B	Perform general woodworking machine operations	4
MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM13003B	Work safely with industrial chemicals and materials	2

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	4
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**Path: 1 Total Path Weight: 52**

MEM04010B	Develop and manufacture wood patterns	20
MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM04018B	Perform general woodworking machine operations	4
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**Path: 1 Total Path Weight: 11**

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM04019B	Perform refractory installation and repair	4
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**Path: 1 Total Path Weight: 8**

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM04020A	Supervise individual ferrous melting and casting operation	4
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**Path: 1 Total Path Weight: 40**

MEM04001B	Operate melting furnaces	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04007B	Pour molten metal	4
MEM09002B	Interpret technical drawing	4
MEM13004B	Work safely with molten metals/glass	2
MEM18001C	Use hand tools	2

MEM04021A	Supervise individual non ferrous melting and casting operation	4
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**Path: 1 Total Path Weight: 43**

MEM04001B	Operate melting furnaces	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04007B	Pour molten metal	4
MEM09002B	Interpret technical drawing	4
MEM13004B	Work safely with molten metals/glass	2
MEM18001C	Use hand tools	2

MEM04022A	Examine appropriateness of methoding for mould design	4
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**Path: 1 Total Path Weight: 30**

MSATCM304A	MSATCM304A Interpret basic binary phase diagrams	4
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM09002B	Interpret technical drawing	4
MEM18001C	Use hand tools	2

MEM04023A	Undertake prescribed tests on foundry related materials	4
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**Path: 1 Total Path Weight: 8**

MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4
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## 0500 Fabrication

Unit code	Unit title	P
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MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
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MEM05002B	Perform high reliability soldering and desoldering	4
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**Path: 1 Total Path Weight: 8**

MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
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MEM05003B	Perform soft soldering	2
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MEM05004C	Perform routine oxy acetylene welding	2
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MEM05005B	Carry out mechanical cutting	2
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**Path: 1 Total Path Weight: 9**

MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM05006C	Perform brazing and/or silver soldering	2
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MEM05007C	Perform manual heating and thermal cutting	2
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MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	2
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**Path: 1 Total Path Weight: 4**

MEM05007C	Perform manual heating and thermal cutting	2
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MEM05009C	Perform automated thermal cutting	2
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**Path: 1 Total Path Weight: 7**

MEM12023A	Perform engineering measurements	5
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MEM05010C	Apply fabrication, forming and shaping techniques	8
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**Path: 1 Total Path Weight: 28**

MEM05037C	Perform geometric development	6
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM12024A	Perform computations	3
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MEM18001C	Use hand tools	2
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MEM05011D	Assemble fabricated components	8
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**Path: 1 Total Path Weight: 37**

MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 2 Total Path Weight: 37**

MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 3 Total Path Weight: 39**

MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05022C	Perform advanced welding using oxy acetylene welding	6
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 4 Total Path Weight: 37**

MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05017D	Weld using gas metal arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05012C	Perform routine manual metal arc welding	2
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MEM05013C	Perform manual production welding	2
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MEM05014C	Monitor quality of production welding/fabrications	2
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**Path: 1 Total Path Weight: 23**

MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 2 Total Path Weight: 23**

MEM05017D	Weld using gas metal arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 3 Total Path Weight: 23**

MEM05019D	Weld using gas tungsten arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5



MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 4 Total Path Weight: 21**

MEM05004C	Perform routine oxy acetylene welding	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05015D	Weld using manual metal arc welding process	4
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**Path: 1 Total Path Weight: 21**

MEM05012C	Perform routine manual metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05016C	Perform advanced welding using manual metal arc welding process	4
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**Path: 1 Total Path Weight: 31**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding	4

process

MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05017D	Weld using gas metal arc welding process	4
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**Path: 1 Total Path Weight: 21**

MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05018C	Perform advanced welding using gas metal arc welding process	4
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**Path: 1 Total Path Weight: 31**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05017D	Weld using gas metal arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05019D	Weld using gas tungsten arc welding process	4
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**Path: 1 Total Path Weight: 21**

MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
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**Path: 1 Total Path Weight: 31**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05022C	Perform advanced welding using oxy acetylene welding process	6
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**Path: 1 Total Path Weight: 24**

MEM05004C	Perform routine oxy acetylene welding	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05023C	Weld using submerged arc welding process	4
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**Path: 1 Total Path Weight: 9**

MEM12023A	Perform engineering measurements	5
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MEM05024B	Perform welding supervision	12
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**Path: 1 Total Path Weight: 16**

MEM05026C	Apply welding principles	4
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MEM05025C	Perform welding/fabrication inspection	12
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**Path: 1 Total Path Weight: 21**

MEM05026C	Apply welding principles	4
MEM12023A	Perform engineering measurements	5

MEM05026C	Apply welding principles	4
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MEM05027A	Perform aluminothermic welding	2
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MEM05036C	Repair/replace/modify fabrications	4
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**Path: 1 Total Path Weight: 41**

MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 2 Total Path Weight: 41**

MEM05005B	Carry out mechanical cutting	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05011D	Assemble fabricated components	8
MEM05017D	Weld using gas metal arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18002B	Use power tools/hand held operations	2
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**Path: 3 Total Path Weight: 43**

MEM05004C	Perform routine oxy acetylene welding	2
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MEM05005B	Carry out mechanical cutting	2
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MEM05007C	Perform manual heating and thermal cutting	2
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MEM05011D	Assemble fabricated components	8
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MEM05022C	Perform advanced welding using oxy acetylene welding	6
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MEM05051A	Select welding processes	2
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MEM05052A	Apply safe welding practices	4
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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**Path: 4 Total Path Weight: 41**

MEM05005B	Carry out mechanical cutting	2
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MEM05007C	Perform manual heating and thermal cutting	2
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MEM05011D	Assemble fabricated components	8
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MEM05019D	Weld using gas tungsten arc welding process	4
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MEM05049B	Perform routine gas tungsten arc welding	2
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MEM05051A	Select welding processes	2
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MEM05052A	Apply safe welding practices	4
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM05037C	Perform geometric development	6
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**Path: 1 Total Path Weight: 18**

MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM12024A	Perform computations	3
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MEM05038B	Perform advanced geometric development - cylindrical/rectangular	2
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**Path: 1 Total Path Weight: 24**

MEM05037C	Perform geometric development	6
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM12024A	Perform computations	3
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MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4
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MEM05039B	Perform advanced geometric development - conical	2
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**Path: 1 Total Path Weight: 24**

MEM05037C	Perform geometric development	6
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM12024A	Perform computations	3
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MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4
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MEM05040B	Perform advanced geometric development - transitions	4
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**Path: 1 Total Path Weight: 26**

MEM05037C	Perform geometric development	6
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM05041B	Weld using powder flame spraying	4
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**Path: 1 Total Path Weight: 11**

MEM05004C	Perform routine oxy acetylene welding	2
MEM12023A	Perform engineering measurements	5

MEM05042B	Perform welds to code standards using flux core arc welding process	6
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**Path: 1 Total Path Weight: 41**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05026C	Apply welding principles	4
MEM05047B	Weld using flux core arc welding process	4
MEM05048B	Perform advanced welding using flux core arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4



MEM09002B	Interpret technical drawing	4
MEM12023	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05043B	Perform welds to code standards using gas metal arc welding process	6
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**Path: 1 Total Path Weight: 41**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05017D	Weld using gas metal arc welding process	4
MEM05018C	Perform advanced welding using gas metal arc welding	4
MEM05026C	Apply welding principles	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05044B	Perform welds to code standards using gas tungsten arc welding process	6
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**Path: 1 Total Path Weight: 41**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05019D	Weld using gas tungsten arc welding process	4

MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
MEM05026C	Apply welding principles	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05045B	Perform pipe welds to code standards using manual metal arc welding process	6
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**Path: 1 Total Path Weight: 41**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05026C	Apply welding principles	4
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05046B	Perform welds to code standards using manual metal arc welding process	6
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**Path: 1 Total Path Weight: 41**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05026C	Apply welding principles	4
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05047B	Weld using flux core arc welding process	4
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**Path: 1 Total Path Weight: 21**

MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM12023	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05048B	Perform advanced welding using flux core arc welding process	4
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**Path: 1 Total Path Weight: 31**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05047B	Weld using flux core arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12023	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM05049B	Perform routine gas tungsten arc welding	2
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MEM05050B	Perform routine gas metal arc welding	2
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MEM05051A	Select welding processes	2
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MEM05052A	Apply safe welding practices	4
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MEM05053A	Set and edit computer controlled thermal cutting machines	4
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**Path: 1 Total Path Weight: 21**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and	2
MEM05009C	Perform automated thermal cutting	2

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM05054A	Write basic NC/CNC programs for thermal cutting machines	4
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**Path: 1 Total Path Weight: 25**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and	2
MEM05009C	Perform automated thermal cutting	2
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

## 0600 Forging

Unit code	Unit title	P
MEM06001B	Perform hand forging	4

**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM06002B	Perform hammer forging	4
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MEM06003C	Carry out heat treatment	6
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MEM06004B	Select heat treatment processes and test finished product	6
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**Path: 1 Total Path Weight: 12**

MEM06003C	Carry out heat treatment	6
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MEM06005B	Perform drop and upset forging	4
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**Path: 1 Total Path Weight: 8**

MEM06002B	Perform hammer forging	4
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MEM06006C	Repair springs	4
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**Path: 1 Total Path Weight: 16**

MEM06001B	Perform hand forging	4
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MEM06003C	Carry out heat treatment	6
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MEM18001C	Use hand tools	2
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MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
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MEM06008A	Hammer forge complex shapes	4
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**Path: 1 Total Path Weight: 8**

MEM06002B	Perform hammer forging	4
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MEM06009A	Hand forge complex shapes	4
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**Path: 1 Total Path Weight: 8**

MEM06001B	Perform hand forging	4
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## 0700 Machine and Processing

Unit code	Unit title	P
MEM07001B	Perform operational maintenance of machines/equipment	2
<b>Path: 1 Total Path Weight: 4</b>		
MEM18001C	Use hand tools	2
MEM07002B	Perform precision shaping/planing/slotting operations	4
<b>Path: 1 Total Path Weight: 25</b>		
MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM07003B	Perform machine setting (routine)	4
<b>Path: 1 Total Path Weight: 17</b>		
MEM07024B	Operate and monitor machine/process	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2
MEM07004B	Perform machine setting (complex)	8
<b>Path: 1 Total Path Weight: 33</b>		
MEM07005C	Perform general machining	8

MEM07006C	Perform lathe operations	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 33**

MEM07005C	Perform general machining	8
MEM07007C	Perform milling operations	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

**Path: 3 Total Path Weight: 33**

MEM07005C	Perform general machining	8
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

**Path: 4 Total Path Weight: 33**

MEM07005C	Perform general machining	8
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2



MEM18001C	Use hand tools	2
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**Path: 5 Total Path Weight: 37**

MEM07001B	Perform operational maintenance of machines/equipment	2
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MEM07003B	Perform machine setting (routine)	4
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MEM07024B	Operate and monitor machine/process	4
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MEM07025B	Perform advanced machine/process operation	6
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM16006A	Organise and communicate information	2
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MEM18001C	Use hand tools	2
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**Path: 6 Total Path Weight: 37**

MEM07001B	Perform operational maintenance of machines/equipment	2
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MEM07003B	Perform machine setting (routine)	4
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MEM07024B	Operate and monitor machine/process	4
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MEM07026B	Perform advanced plastic processing	6
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MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM16006A	Organise and communicate information	2
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MEM18001C	Use hand tools	2
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**Path: 7 Total Path Weight: 37**

MEM07001B	Perform operational maintenance of machines/equipment	2
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MEM07003B	Perform machine setting (routine)	4
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MEM07024B	Operate and monitor machine/process	4
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MEM07027B	Perform advanced press operations	6
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

MEM07005C	Perform general machining	8
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**Path: 1 Total Path Weight: 19**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07006C	Perform lathe operations	4
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**Path: 1 Total Path Weight: 23**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07007C	Perform milling operations	4
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**Path: 1 Total Path Weight: 23**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07008D	Perform grinding operations	4
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**Path: 1 Total Path Weight: 23**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07009B	Perform precision jig boring operations	4
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**Path: 1 Total Path Weight: 29**

MEM07005C	Perform general machining	8
MEM07007C	Perform milling operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07010B	Perform tool and cutter grinding operations	4
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**Path: 1 Total Path Weight: 29**

MEM07005C	Perform general machining	8
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07011B	Perform complex milling operations	4
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**Path: 1 Total Path Weight: 32**

MEM07005C	Perform general machining	8
MEM07007C	Perform milling operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2

MEM07012B	Perform complex grinding operations	4
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**Path: 1 Total Path Weight: 29**

MEM07005C	Perform general machining	8
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
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**Path: 1 Total Path Weight: 23**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07014B	Perform electro-discharge (EDM) machining operations	4
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**Path: 1 Total Path Weight: 23**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 14**

MEM07024B	Operate and monitor machine/process	4
MEM09002B	Interpret technical drawing	4
MEM18001C	Use hand tools	2

MEM07015B	Set computer controlled machines/processes	2
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**Path: 1 Total Path Weight: 19**

MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 21**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07016C	Set and edit computer controlled machines/processes	4
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**Path: 1 Total Path Weight: 23**

MEM07015B	Set computer controlled machines/processes	2
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 25**

MEM07005C	Perform general machining	8
MEM07015B	Set computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07018C	Write basic NC/CNC programs	4
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**Path: 1 Total Path Weight: 27**

MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 29**

MEM07005C	Perform general machining	8
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07019C	Program NC/CNC machining centre	2
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**Path: 1 Total Path Weight: 29**

MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 31**

MEM07005C	Perform general machining	8
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM09002B	Interpret technical drawing	4

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
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**Path: 1 Total Path Weight: 31**

MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 33**

MEM07005C	Perform general machining	8
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2



MEM07021B	Perform complex lathe operations	4
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**Path: 1 Total Path Weight: 32**

MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2

MEM07022C	Program CNC wire cut machines	2
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**Path: 1 Total Path Weight: 31**

MEM07005C	Perform general machining	8
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 29**

MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4

MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machine/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07023C	Program and set up CNC manufacturing cell	6
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**Path: 1 Total Path Weight: 37**

MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 47**

MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07015B	Set computer controlled machines/processes	2

MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07024B	Operate and monitor machine/process	4
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MEM07025B	Perform advanced machine/process operation	6
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**Path: 1 Total Path Weight: 25**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07024B	Operate and monitor machine/process	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

MEM07026B	Perform advanced plastic processing	6
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**Path: 1 Total Path Weight: 25**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07024B	Operate and monitor machine/process	4

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

MEM07027B	Perform advanced press operations	6
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**Path: 1 Total Path Weight: 25**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07024B	Operate and monitor machine/process	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2

MEM07028B	Operate computer controlled machines/processes	2
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**Path: 1 Total Path Weight: 6**

MEM07024B	Operate and monitor machine/process	4
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MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
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**Path: 1 Total Path Weight: 11**

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07030C	Perform metal spinning lathe operations (basic)	8
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**Path: 1 Total Path Weight: 17**

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM07031C	Perform metal spinning lathe operations (complex)	4
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**Path: 1 Total Path Weight: 27**

MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07032B	Use workshop machines for basic operations	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM07032B	Use workshop machines for basic operations	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM07033B	Operate and monitor basic boiler	6
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MEM07034A	Operate and monitor intermediate class boiler	4
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**Path: 1 Total Path Weight: 10**

MEM07033B	Operate and monitor basic boiler	6
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MEM07039A	Write programs for industrial robots	4
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**Path: 1 Total Path Weight: 17**

MEM09002B	Interpret technical drawing	4
MEM10004B	Enter and change programmable controller operational parameters	2
MEM12023A	Perform engineering measurements	5
MEM16008A	Interact with computing technology	2

MEM07040A	Set multistage integrated processes	6
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**Path: 1 Total Path Weight: 25**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM14005A	Plan a complete activity	4
MEM16006A	Organise and communicate information	2
MEM16008A	Interact with computing technology	2
MEM18001C	Use hand tools	2

MEM07041A	Perform production machining	8
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**Path 1: Total Path Weight: 19**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM07042A	Undertake corrections and basic maintenance to aluminium extrusion dies and die support systems	4
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**Path 1: Total Path Weight: 60**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07032B	Use workshop machines for basic operations	2
MEM07043A	Identify causes of faulty aluminium extrusions	6
MEM07044A	Test a new aluminium extrusion die	4
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM07043A	Identify causes of faulty aluminium extrusions	6
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**Path 1: Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM15002A	Apply quality systems	2
MEM15024A	Apply quality procedures	0
MEM16006A	Organise and communicate information	2

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM07044A	Test a new aluminium extrusion die	4
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**Path 1: Total Path Weight: 26**

MEM07043A	Identify causes of faulty aluminium extrusions	6
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

## 0800 Surface Finishing

Unit code	Unit title	P
MEM08001B	Perform wire, jig and barrel load/unload work	4

MEM08002C	Pre-treat work for subsequent surface coating	4
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**Path: 1 Total Path Weight: 6**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08003C	Perform electroplating operations	6
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**Path: 1 Total Path Weight: 16**

MEM07001B	Perform operational maintenance of	2
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machines/equipment

MEM08001B Perform wire, jig and barrel load/unload work 4

MEM13003B Work safely with industrial chemicals and materials 2

MEM18001C Use hand tools 2

MEM08004B Finish work using wet, dry and vapour deposition methods 4

**Path: 1 Total Path Weight: 10**

MEM08002C Pre-treat work for subsequent surface coating 4

MEM13003B Work safely with industrial chemicals and materials 2

MEM08005B Prepare and produce specialised coatings 4

**Path: 1 Total Path Weight: 10**

MEM08002C Pre-treat work for subsequent surface coating 4

MEM13003B Work safely with industrial chemicals and materials 2

MEM08006B Produce clear and/or coloured and/or sealed anodised films on aluminium 2

**Path: 1 Total Path Weight: 6**

MEM08002C Pre-treat work for subsequent surface coating 4

MEM08007B Control surface finish production and finished product quality 4

MEM08008B	Operate and control surface finishing waste treatment process	3
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**Path: 1 Total Path Weight: 5**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08009C	Make up solutions	2
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**Path: 1 Total Path Weight: 4**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08010B	Manually finish/polish materials	6
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**Path: 1 Total Path Weight: 8**

MEM18001C	Use hand tools	2
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MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
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**Path: 1 Total Path Weight: 8**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
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**Path: 1 Total Path Weight: 7**

MEM08016B	Control blast coating by-products, materials and emissions	1
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MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
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**Path: 1 Total Path Weight: 11**

MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM13003B	Work safely with industrial chemicals and materials	2

MEM08014B	Apply protective coatings (basic)	4
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**Path: 1 Total Path Weight: 6**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08015B	Apply protective coatings (advanced)	4
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**Path: 1 Total Path Weight: 10**

MEM08014B	Apply protective coatings (basic)	4
MEM13003B	Work safely with industrial chemicals and materials	2

MEM08016B	Control blast coating by-products, materials and emissions	1
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**Path: 1 Total Path Weight: 3**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM08018B	Electroplate engineering coatings	6
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**Path: 1 Total Path Weight: 22**

MEM07001B	Perform operational maintenance of machines/equipment	2
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MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08003C	Perform electroplating operations	6
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

MEM08019B	Electroplate protective finishes	6
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**Path: 1 Total Path Weight: 22**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08003C	Perform electroplating operations	6
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

MEM08020B	Electroplate decorative finishes	6
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**Path: 1 Total Path Weight: 22**

MEM07001B	Perform operational maintenance of machines/equipment	2
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08003C	Perform electroplating operations	6
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

## 0900 Drawing, drafting and design

Unit code	Unit title	P
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
<b>Path: 1 Total Path Weight: 12</b>		
MEM09002B	Interpret technical drawing	4
MEM09004B	Perform electrical/electronic detail drafting	8
<b>Path: 1 Total Path Weight: 20</b>		
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09005B	Perform basic engineering detail drafting	8
<b>Path: 1 Total Path Weight: 20</b>		
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09006B	Perform advanced engineering detail drafting	4
<b>Path: 1 Total Path Weight: 24</b>		
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09005B	Perform basic engineering detail drafting	8

MEM09007B	Perform advanced mechanical detail drafting	4
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**Path: 1 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
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MEM09003B	Prepare basic engineering drawing	8
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MEM09005B	Perform basic engineering detail drafting	8
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MEM09006B	Perform advanced engineering detail drafting	4
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MEM09008B	Perform advanced structural detail drafting	4
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**Path: 1 Total Path Weight: 8**

MEM09002B	Interpret technical drawing	4
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MEM09009C	Create 2D drawings using computer aided design system	8
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**Path: 1 Total Path Weight: 14**

MEM09002B	Interpret technical drawing	4
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MEM16008A	Interact with computing technology	2
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MEM09010C	Create 3D models using computer aided design system	4
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**Path: 1 Total Path Weight: 18**

MEM09002B	Interpret technical drawing	4
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MEM09009C	Create 2D drawings using computer aided design system	8
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MEM16008A	Interact with computing technology	2
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MEM09011B	Apply basic engineering design concepts	6
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**Path: 1 Total Path Weight: 10**

MEM09002B	Interpret technical drawing	4
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MEM09021B	Interpret and produce curved 3-dimensional shapes	4
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MEM09022A	Create 2D code files using computer aided manufacturing system	4
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**Path: 1 Total Path Weight: 15**

MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM16008A	Interact with computing technology	2
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MEM09023A	Create 3D code files using computer aided manufacturing system	6
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**Path: 1 Total Path Weight: 21**

MEM09002B	Interpret technical drawing	4
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MEM09022A	Create 2D code files using computer aided manufacturing	4
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MEM12023A	Perform engineering measurements	5
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MEM16008A	Interact with computing technology	2
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MEM09143A	Represent aeronautical engineering designs	0
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MEM16008A	Interact with computing technology	
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MEM30007A	Select common engineering materials	
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MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations	
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MEM09144A	Represent avionic engineering designs	0
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	MEM16008A	Interact with computing technology	
	MEM30007A	Select common engineering materials	
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	
MEM09153A	Apply computer-aided modelling and data management techniques to aeronautical engineering designs		0
	MEM09143A	Represent aeronautical engineering designs	
	MEM16008A	Interact with computing technology	
	MEM30007A	Select common engineering materials	
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	
MEM09154A	Apply computer-aided modelling and data management techniques to avionic engineering designs		0
	MEM09144A	Represent avionic engineering designs	
	MEM16008A	Interact with computing technology	
	MEM30007A	Select common engineering materials	
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	
MEM09155A	Prepare mechanical models for computer-aided engineering (CAE)		0
	MEM23004A	Apply technical mathematics	
	MEM23109A	Apply engineering mechanics principles	
MEM09156	Prepare mechatronic models for computer-aided engineering (CAE)		0



MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanics principles
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

MEM09157A	Perform mechanical engineering design drafting	0
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MEM09158A	Perform mechatronics engineering design drafting	0
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MEM09201A	Work effectively in an engineering drafting workplace	0
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MEM09202A	Produce freehand sketches	0
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MEM09203A	Measure and sketch site information	0
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MEM09204A	Produce basic engineering detail drawings	0
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MEM09002B	Interpret technical drawing
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MEM09205A	Produce electrical schematic drawings	0
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MEM09002B	Interpret technical drawing
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MEM09204A	Produce basic engineering detail drawings
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MEM09206A	Produce drawings for mechanical services	0
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	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09207A	Produce drawings for reticulated services		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09208A	Detail fasteners and locking devices in mechanical drawings		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09209A	Detail bearings, seals and other componentry in mechanical drawings		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09210A	Create 3-D solid models using computer-aided design (CAD) system		0
	MEM09002B	Interpret technical drawing	
	MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM09211A	Produce drawings or models for industrial piping		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09212A	Produce detailed drawings of steel to non-steel connections		0

	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09213A	Produce schematic drawings for hydraulic and pneumatic fluid power systems		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
MEM09214A	Perform advanced engineering detail drafting		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
	MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	
MEM09215A	Supervise detail drafting projects		0
	MEM09002B	Interpret technical drawing	
	MEM09204A	Produce basic engineering detail drawings	
	MEM09214A	Perform advanced engineering detail drafting	
	MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	
	MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM09216A	Interpret and produce curved 3-D shapes and patterns		0
MEM09217A	Prepare plans for pipe and duct fabrication		0

MEM09002B Interpret technical drawing

MEM09218A Participate in drafting projects for building services 0

MEM09002B Interpret technical drawing

MEM09204A Produce basic engineering detail drawings

MEM09219A Prepare drawings for fabricated sheet metal products 0

MEM09002B Interpret technical drawing

MEM09220A Apply surface modelling techniques to 3-D drawings 0

MEM09002B Interpret technical drawing

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

MEM09221A Create 3-D model assemblies using computer-aided design (CAD) system 0

MEM09002B Interpret technical drawing

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

MEM09222A Interpret and maintain or restore original drawings 0

MEM30032A Produce basic engineering drawings

## 1000 Installation and commissioning

Unit code

Unit title

P

MEM10001C	Erect structures	4
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**Path: 1 Total Path Weight: 37**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

**Path: 2 Total Path Weight: 37**

MEM05007C	Perform manual heating and thermal cutting	2
MEM05017D	Weld using gas metal arc welding process	4
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM09002B	Interpret technical drawing	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM10002B	Terminate and connect electrical wiring	3
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**Path: 1 Total Path Weight: 11**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM18001C	Use hand tools	2

MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
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**Path: 1 Total Path Weight: 33**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3

MEM10004B	Enter and change programmable controller operational parameters	2
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**Path: 1 Total Path Weight: 8**

MEM09002B	Interpret technical drawing	4
MEM16008A	Interact with computing technology	2

MEM10005B	Commission programmable controller programs	4
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**Path: 1 Total Path Weight: 12**

MEM09002B	Interpret technical drawing	4
MEM10004B	Enter and change programmable controller operational parameters	2
MEM16008A	Interact with computing technology	2

MEM10006B	Install machine/plant	4
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM10007C	Modify control systems	6
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**Path: 1 Total Path Weight: 61**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find repair/rectify complex electrical circuits	6

**Path: 2 Total Path Weight: 89**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM14005A	Plan a complete activity	4
MEM16006A	Organise and communicate information	2
MEM16010A	Write reports	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18018C	Maintain pneumatic system components	4



MEM18019B	Maintain pneumatic systems	4
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18023B	Modify fluid power system operation	8
MEM18055B	Dismantle, replace and assemble engineering components	3

**Path: 3 Total Path Weight: 66**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18067B	Tune control loops - multi controller or multi element systems	6

**Path: 4 Total Path Weight: 65**

MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18058C	Modify electronic equipment	4
MEM18059B	Modify electronic systems	4
MEM18065B	Diagnose and repair digital equipment and components	10

**Path: 5 Total Path Weight: 38**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18088B	Maintain and repair commercial air conditioning systems and components	4

MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6
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**Path: 6 Total Path Weight: 40**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18090B	Maintain and repair industrial refrigeration systems and components	6
MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6

**Path: 7 Total Path Weight: 48**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18089B	Maintain and repair central air handling systems	6

MEM18090B	Maintain and repair industrial refrigeration systems and components	6
MEM18093B	Maintain and repair integrated industrial refrigeration and/or large air handling system controls	8

**Path: 8 Total Path Weight: 60**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18064B	Maintain instrumentation system components	6
MEM18067B	Tune control loops - multi controller or multi element systems	6

MEM10008B	Undertake commissioning procedures for plant and/or equipment	4
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**Path: 1 Total Path Weight: 38**

MEM09002B	Interpret technical drawing	4
MEM10006B	Install machine/plant	4
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

**Path: 2 Total Path Weight: 32**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18090B	Maintain and repair industrial refrigeration systems and components	6

**Path: 3 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18089B	Maintain and repair central air handling systems	6
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**Path: 4 Total Path Weight: 40**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM10009B	Install refrigeration and air conditioning plant and equipment	4
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**Path: 1 Total Path Weight: 30**

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM10010B	Install pipework and pipework assemblies	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

MEM10010B	Install pipework and pipework assemblies	4
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**Path: 1 Total Path Weight: 17**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM10011B	Terminate and connect specialist cables	3
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**Path: 1 Total Path Weight: 14**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM18001C	Use hand tools	2

MEM10013A	Install split air conditioning systems and associated pipework	6
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**Path: 1 Total Path Weight: 24**

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

## 1100 Materials handling

Unit code	Unit title	P
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MEM11001C	Erect/dismantle scaffolding and equipment	4
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM11002C	Erect/dismantle complex scaffolding and equipment	4
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**Path: 1 Total Path Weight: 10**

MEM11001C	Erect/dismantle scaffolding and equipment	4
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MEM18001C	Use hand tools	2
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MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4
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**Path: 1 Total Path Weight: 14**

MEM11001C	Erect/dismantle scaffolding and equipment	4
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MEM11002C	Erect/dismantle complex scaffolding and equipment	4
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MEM18001C	Use hand tools	2
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MEM11004B	Undertake dogging	4
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM11005B	Pick and process order	4
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MEM11006B	Perform production packaging	2
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MEM11007B	Administer inventory procedures	4
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MEM11008B	Package materials (stores and warehouse)	2
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MEM11009B	Handle/move bulk fluids/gases	4
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MEM11010B	Operate mobile load shifting equipment	4
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MEM11011B	Undertake manual handling	2
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MEM11012B	Purchase materials	6
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MEM11013B	Undertake warehouse receipt process	4
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**Path: 1 Total Path Weight: 6**

MEM11011B	Undertake manual handling	2
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MEM11014B	Undertake warehouse dispatch process	4
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**Path: 1 Total Path Weight: 8**

MEM11006B	Perform production packaging	2
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MEM11011B	Undertake manual handling	2
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**Path: 2 Total Path Weight: 8**

MEM11008B	Package materials (stores and warehouse)	2
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MEM11011B	Undertake manual handling	2
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MEM11015B	Manage warehouse inventory system	6
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**Path: 1 Total Path Weight: 12**

MEM11007B	Administer inventory procedures	4
MEM15002A	Apply quality systems	2

MEM11016B	Order materials	2
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MEM11017B	Organise and lead stocktakes	4
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**Path: 1 Total Path Weight: 8**

MEM11007B	Administer inventory procedures	4
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MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
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**Path: 1 Total Path Weight: 14**

MEM11006B	Perform production packaging	2
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MEM11011B	Undertake manual handling	2
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MEM11013B	Undertake warehouse receipt process	4
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**Path: 2 Total Path Weight: 14**

MEM11008B	Package materials (stores and warehouse)	2
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MEM11011B	Undertake manual handling	2
-----------	---------------------------	---

MEM11013B	Undertake warehouse receipt process	4
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**Path: 3 Total Path Weight: 14**

MEM11006B	Perform production packaging	2
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MEM11011B	Undertake manual handling	2
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MEM11014B	Undertake warehouse dispatch process	4
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**Path: 4 Total Path Weight: 14**

MEM11008B	Package materials (stores and warehouse)	2
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MEM11011B	Undertake manual handling	2
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MEM11014B	Undertake warehouse dispatch process	4
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MEM11019B	Undertake tool store procedures	4
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**Path: 1 Total Path Weight: 17**

MEM11007B	Administer inventory procedures	4
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MEM11011B	Undertake manual handling	2
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MEM11013B	Undertake warehouse receipt process	4
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MEM12024A	Perform computations	3
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MEM11020B	Perform advanced warehouse computer operations	4
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**Path: 1 Total Path Weight: 6**

MEM16008A	Interact with computing technology	2
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MEM11021B	Perform advanced operation of load shifting equipment	2
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**Path: 1 Total Path Weight: 6**

MEM11010B	Operate mobile load shifting equipment	4
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MEM11022B	Operate fixed/moveable load shifting equipment	4
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MEM11023A	Operate a bridge and gantry crane	4
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MEM11024A	Undertake basic rigging	4
-----------	-------------------------	---

**Path: 1 Total Path Weight: 8**

MEM11004B	Undertake dogging	4
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MEM11025A	Operate a non-slewing mobile crane of greater than three tonnes	4
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capacity

## 1200 Measurement

Unit code	Unit title	P
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MEM12001B	Use comparison and basic measuring devices	2
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MEM12002B	Perform electrical/electronic measurement	2
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MEM12003B	Perform precision mechanical measurement	2
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### Path: 1 Total Path Weight: 7

MEM12023A	Perform engineering measurements	5
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MEM12004B	Perform precision electrical/electronic measurement	4
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MEM12005B	Calibrate measuring equipment	6
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### Path: 1 Total Path Weight: 13

MEM12003B	Perform precision mechanical measurement	2
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MEM12023A	Perform engineering measurements	5
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### Path: 2 Total Path Weight: 13

MEM12002B	Perform electrical/electronic measurement	2
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MEM12023A	Perform engineering measurements	5
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MEM12006C	Mark off/out (general engineering)	4
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### Path: 1 Total Path Weight: 13

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5

MEM12007D	Mark off/out structural fabrications and shapes	4
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**Path: 1 Total Path Weight: 9**

MEM12023A	Perform engineering measurements	5
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MEM12019B	Measure components using coordinate measuring machine	4
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MEM12020B	Set and operate coordinate measuring machine	2
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MEM12021B	Program coordinate measuring machine	4
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**Path: 1 Total Path Weight: 15**

MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5

MEM12022B	Program coordinate measuring machine (advanced)	2
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**Path: 1 Total Path Weight: 13**

MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5

MEM12023A	Perform engineering measurements	5
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MEM12024A	Perform computations	3
-----------	----------------------	---

MEM12025A	Use graphical techniques and perform simple statistical computations	2
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**Path: 1 Total Path Weight: 5**

MEM12024A	Perform computations	3
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## 1300 OHS

Unit code	Unit title	P
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MEM13001B	Perform emergency first aid	1
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MEM13002B	Undertake occupational health and safety activities in the workplace	3
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MEM13003B	Work safely with industrial chemicals and materials	2
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MEM13004B	Work safely with molten metals/glass	2
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MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise	4
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MEM13007B	Maintain water treatment systems for cooling towers	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM13010A	Supervise occupational health and safety in an industrial work	4
-----------	--	---

environment

**Path: 1 Total Path Weight: 7**

MEM13002B	Undertake occupational health and safety activities in the workplace	3
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MEM13013B	Work safely with ionizing radiation	4
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MEM13014A	Apply principles of occupational health and safety in the work environment	0
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**1400 Planning**

Unit code	Unit title	P
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MEM14001B	Schedule material deliveries	8
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MEM14002B	Undertake basic process planning	8
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MEM14003B	Undertake basic production scheduling	8
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MEM14004A	Plan to undertake a routine task	0
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MEM14005A	Plan a complete activity	4
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MEM14065A	Plan and design aeronautical engineering projects	0
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MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
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MEA350A	Select and test aeronautical engineering materials
MEM14083A	Apply aeronautical engineering fundamentals to support design and development of projects
MEM16008A	Interact with computing technology
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques
MEM23084A	Apply scientific principles and techniques in aeronautical engineering situations
MEM23095A	Apply aeronautical system design principles and techniques in engineering situations
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

MEM14066A	Plan and design avionic engineering projects	0
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MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
MEA273A	Select and test avionic engineering materials
MEM14084A	Apply avionic engineering fundamentals to support design and development of projects
MEM16008A	Interact with computing technology
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques
MEM23086A	Apply scientific principles and techniques in avionic engineering situations



	MEM23096A	Apply avionic system design principles and techniques in engineering situations	
	MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations	
MEM14083A	Apply aeronautical engineering fundamentals to support design and development of engineering projects		0
	MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations	
	MEM16008A	Interact with computing technology	
	MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	
	MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations	
MEM14084A	Apply avionic engineering fundamentals to support design and development of engineering projects		0
	MEA272A	Apply basic scientific principles and techniques in avionic engineering situations	
	MEM16008A	Interact with computing technology	
	MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations	
MEM14085A	Apply mechanical engineering analysis techniques		0
	MEM23004A	Apply technical mathematics	
	MEM23109A	Apply engineering mechanic principles	

MEM14086A	Apply mechatronic engineering analysis techniques	0
	MEM23004A	Apply technical mathematics
	MEM23111A	Select electrical equipment and components for engineering applications
	MEM23112A	Investigate electrical and electronic controllers in engineering applications
	MEM14090A	Integrate mechatronic fundamentals into an engineering task
MEM14087A	Apply manufactured product design techniques	0
	MEM14089A	Integrate mechanical fundamentals into an engineering task
	MEM23004A	Apply technical mathematics
	MEM23063A	Select and test mechanical engineering materials
	MEM23109A	Apply engineering mechanic principles
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications	0
	MEM14092A	Integrate maintenance fundamentals into an engineering task
MEM14089A	Integrate mechanical fundamentals into an engineering task	0
	MEM23004A	Apply technical mathematics
	MEM23109A	Apply engineering mechanics principles
MEM14090A	Integrate mechatronic fundamentals into an engineering task	0
	MEM23004A	Apply technical mathematics
	MEM23111A	Select electrical equipment and components

for engineering applications

MEM23112A Investigate electrical and electronic  
controllers in engineering applications

MEM14091A Integrate manufacturing fundamentals into an engineering task 0

MEM23004A Apply technical mathematics

MEM14092A Integrate maintenance fundamentals into an engineering task 0

MEM23004A Apply technical mathematics

## 1500 Quality

Unit code	Unit title	P
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MEM15001B	Perform basic statistical quality control	2
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MEM15002A	Apply quality systems	2
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MEM15003B	Use improvement processes in team activities	4
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**Path: 1 Total Path Weight: 4**

MEM16007A	Work with others in a manufacturing, engineering or related environment	0
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MEM15004B	Perform inspection	2
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MEM15005B	Select and control inspection processes and procedures	4
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**Path: 1 Total Path Weight: 6**

MEM15004B	Perform inspection	2
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MEM15007B	Conduct product and/or process capability studies	6
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**Path: 1 Total Path Weight: 15**

MEM12024A	Perform computations	3
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MEM12025A	Use graphical techniques and perform simple statistical computations	2
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MEM15001B	Perform basic statistical quality control	2
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MEM15008B	Perform advanced statistical quality control	2
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MEM15008B	Perform advanced statistical quality control	2
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**Path: 1 Total Path Weight: 9**

MEM12024A	Perform computations	3
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MEM12025A	Use graphical techniques and perform simple statistical computations	2
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MEM15001B	Perform basic statistical quality control	2
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MEM15010B	Perform laboratory procedures	8
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MEM15011B	Exercise external quality assurance	6
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**Path: 1 Total Path Weight: 12**

MEM15004B	Perform inspection	2
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MEM15005B	Select and control inspection processes and procedures	4
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MEM15012B	Maintain/supervise the application of quality procedures	4
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**Path: 1 Total Path Weight: 11**

MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM15001B	Perform basic statistical quality control	2

MEM15015B	Examine trading practices	5
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**Path: 1 Total Path Weight: 10**

MEM12023A	Perform engineering measurements	5
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MEM15016B	Inspect pre-packed articles	8
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**Path: 1 Total Path Weight: 10**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM15017B	Use and maintain reference standards	3
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**Path: 1 Total Path Weight: 26**

MEM11011B	Undertake manual handling	2
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12005B	Calibrate measuring equipment	6
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM15018B	Investigate consumer complaints	6
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**Path: 1 Total Path Weight: 36**

MEM11011B	Undertake manual handling	2
MEM12023A	Perform engineering measurements	5
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM15015B	Examine trading practices	5
MEM15016B	Inspect pre-packed articles	8
MEM16004B	Perform internal/external customer service	2
MEM18001C	Use hand tools	2

MEM15019B	Conduct a field inspection	12
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**Path: 1 Total Path Weight: 75**

MEM09002B	Interpret technical drawing	4
MEM11011B	Undertake manual handling	2
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12005B	Calibrate measuring equipment	6
MEM12023A	Perform engineering measurements	5
MEM13003B	Work safely with industrial chemicals and materials	2
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM15015B	Examine trading practices	5
MEM15016B	Inspect pre-packed articles	8
MEM15017B	Use and maintain reference standards	3

MEM15018B	Investigate consumer complaints	6
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM15020C	Perform verification/certification or in-service inspection	12
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**Path: 1 Total Path Weight: 25**

MEM09002B	Interpret technical drawing	4
MEM11011B	Undertake manual handling	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM15021C	Conduct audits of servicing licensees and public weighbridge licensees	4
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**Path: 1 Total Path Weight: 14**

MEM09002B	Interpret technical drawing	4
MEM11011B	Undertake manual handling	2
MEM16004B	Perform internal/external customer service	2
MEM18001C	Use hand tools	2

MEM15022B	Verify reference standards	8
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**Path: 1 Total Path Weight: 21**

MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
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MEM15024A	Apply quality procedures	0
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## 1600 Communication

Unit code	Unit title	P
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MEM16001B	Give formal presentations and take part in meetings	2
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MEM16002C	Conduct formal interviews and negotiations	4
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MEM16003B	Provide advanced customer service	2
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MEM16004B	Perform internal/external customer service	2
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MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
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MEM16006A	Organise and communicate information	2
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MEM16007A	Work with others in a manufacturing, engineering or related environment	0
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MEM16008A	Interact with computing technology	2
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MEM16009A	Research and analyse engineering information	2
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**Path: 1 Total Path Weight: 8**

MEM16006A	Organise and communicate information	MEM16006A
MEM16012A	Interpret technical specifications and manuals	MEM16012A

MEM16010A	Write reports	2
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**Path: 1 Total Path Weight: 6**

MEM14005A	Plan a complete activity	4
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MEM16011A	Communicate with individuals and small groups	2
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**Path: 1 Total Path Weight: 4**

MEM16006A	Organise and communicate information	2
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MEM16012A	Interpret technical specifications and manuals	4
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MEM16013A	Operate in a self-directed team	2
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**Path: 1 Total Path Weight: 2**

MEM16007A	Work with others in a manufacturing, engineering or related environment	0
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MEM16014A	Report technical information	2
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**Path: 1 Total Path Weight: 4**

MEM16006A	Organise and communicate information	2
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## 1700 Training

Unit code	Unit title	P
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MEM17001B	Assist in development and deliver training in the workplace	2
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MEM17002B	Conduct workplace assessment	2
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MEM17003A	Assist in the provision of on the job training	2
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Unit code	Unit title	P
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM18003C	Use tools for precision work	4
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### Path: 1 Total Path Weight: 13

MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM18004B	Maintain and overhaul mechanical equipment	4
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### Path: 1 Total Path Weight: 42

MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
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**Path: 1 Total Path Weight: 30**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18006C	Repair and fit engineering components	6
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**Path: 1 Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18008B	Balance equipment	2
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**Path: 1 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4

MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18009B	Perform levelling and alignment of machines and engineering components	4
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**Path: 1 Total Path Weight: 30**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18010C	Perform equipment condition monitoring and recording	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18011C	Shut down and isolate machines/equipment	2
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MEM18012B	Perform installation and removal of mechanical seals	2
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**Path: 1 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18013B	Perform gland packing	2
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**Path: 1 Total Path Weight: 9**

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18014B	Manufacture press tools and gauges	8
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**Path: 1 Total Path Weight: 73**

MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2

MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18015B	Maintain tools and dies	4
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM18015B	Maintain tools and dies	4
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**Path: 1 Total Path Weight: 54**

MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18016B	Analyse plant and equipment condition monitoring results	4
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**Path: 1 Total Path Weight: 41**

MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18017C	Modify mechanical systems and equipment	8
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**Path: 1 Total Path Weight: 63**

MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5



MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18011C	Shut down and isolate machines/equipment	2
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18018C	Maintain pneumatic system components	4
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**Path: 1 Total Path Weight: 30**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6

MEM18055B	Dismantle, replace and assemble engineering components	3
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MEM18019B	Maintain pneumatic systems	4
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18018C	Maintain pneumatic system components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18020B	Maintain hydraulic system components	4
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**Path: 1 Total Path Weight: 30**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

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Unit code	Unit title	P
MEM18021B	Maintain hydraulic systems	4

### Path: 1 Total Path Weight: 34

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18020B	Maintain hydraulic system components	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18022B	Maintain fluid power controls	8
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### Path: 1 Total Path Weight: 42

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18018C	Maintain pneumatic system components	4
MEM18019B	Maintain pneumatic systems	4
MEM18055B	Dismantle, replace and assemble engineering components	3

### Path: 2 Total Path Weight: 42

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18023B	Modify fluid power system operation	8
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**Path: 1 Total Path Weight: 71**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18018C	Maintain pneumatic system components	4

MEM18019B	Maintain pneumatic systems	4
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18024B	Maintain engine cooling systems	2
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**Path: 1 Total Path Weight: 18**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18025B	Service combustion engines	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM18026C	Test compression ignition fuel systems	4
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**Path: 1 Total Path Weight: 11**

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18027C	Overhaul engine fuel system components	8
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**Path: 1 Total Path Weight: 24**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18028B	Maintain engine lubrication systems	2
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**Path: 1 Total Path Weight: 18**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18029B	Tune diesel engines	4
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**Path: 1 Total Path Weight: 24**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18026C	Test compression ignition fuel systems	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18030B	Diagnose and rectify low voltage electrical systems	8
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**Path: 1 Total Path Weight: 24**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18031B	Diagnose and rectify low voltage starting systems	2
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**Path: 1 Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18032B	Maintain induction/exhaust systems	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble	3

## engineering components

MEM18033B	Perform engine bottom-end overhaul	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18034B	Perform engine top-end overhaul	8
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18035B	Diagnose and rectify braking systems	6
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**Path: 1 Total Path Weight: 22**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2



MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18037B	Diagnose and rectify low voltage charging systems	2
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**Path: 1 Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18038B	Maintain wheels and tyres	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM18039B	Diagnose and rectify track type undercarriage	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18040B	Maintain suspension systems	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18041B	Maintain steering systems	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18042C	Diagnose and rectify manual transmissions	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18043C	Diagnose and rectify automatic transmissions	8
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**Path: 1 Total Path Weight: 24**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18044C	Diagnose and rectify drive line and final drives	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

## 1800 Maintenance and diagnostics (Page 3)

Unit code	Unit title	P
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4

**Path: 1 Total Path Weight: 22**

MEM09002B	Interpret technical drawing	4
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MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
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**Path: 1 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
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**Path: 1 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18048B	Fault find and repair/rectify basic electrical circuits	12
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**Path: 1 Total Path Weight: 45**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3

MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
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**Path: 1 Total Path Weight: 14**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM18001C	Use hand tools	2

MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
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**Path: 1 Total Path Weight: 14**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3

MEM12002B	Perform electrical/electronic measurement	2
MEM18001C	Use hand tools	2

MEM18051B	Fault find repair/rectify complex electrical circuits	6
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**Path: 1 Total Path Weight: 55**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3

MEM18052B	Maintain fluid power systems for mobile plant	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble	3

## engineering components

MEM18053B	Modify fluid power control systems	6
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**Path: 1 Total Path Weight: 83**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM14005A	Plan a complete activity	4
MEM16010A	Write reports	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18018C	Maintain pneumatic system components	4
MEM18019B	Maintain pneumatic systems	4
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18023B	Modify fluid power system operation	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
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**Path: 1 Total Path Weight: 38**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6

**Path: 2 Total Path Weight: 32**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18064B	Maintain instrumentation system components	6

MEM18055B	Dismantle, replace and assemble engineering components	3
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**Path: 1 Total Path Weight: 16**

MEM09002B	Interpret technical drawing	4
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MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18056B	Diagnose and repair analog equipment and components	10
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**Path: 1 Total Path Weight: 30**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18001C	Use hand tools	2
MEM18057B	Maintain/service analog/digital electronic equipment	6

MEM18057B	Maintain/service analog/digital electronic equipment	6
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**Path: 1 Total Path Weight: 20**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18001C	Use hand tools	2

MEM18058C	Modify electronic equipment	4
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**Path: 1 Total Path Weight: 32**

MEM12004B	Perform precision electrical/electronic measurement	4
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MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18065B	Diagnose and repair digital equipment and components	10

MEM18059B	Modify electronic systems	4
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**Path: 1 Total Path Weight: 55**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18058C	Modify electronic equipment	4
MEM18065B	Diagnose and repair digital equipment and components	10

MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
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**Path: 1 Total Path Weight: 54**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
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MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8

**Path: 2 Total Path Weight: 48**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18064B	Maintain instrumentation system components	6

MEM18061B	Maintain/calibrate complex control systems	8
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**Path: 1 Total Path Weight: 60**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18069B	Maintain, repair instrumentation process control analysers	6

**Path: 2 Total Path Weight: 46**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble	3

engineering components

MEM18064B	Maintain instrumentation system components	6
MEM18069B	Maintain, repair instrumentation process control analysers	6

**Path: 3 Total Path Weight: 68**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18067B	Tune control loops – multi controller or multi element systems	6

**Path: 4 Total Path Weight: 62**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18064B	Maintain instrumentation system components	6
MEM18067B	Tune control loops – multi controller or multi element systems	6

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Unit code	Unit title	P
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8

### Path: 1 Total Path Weight: 46

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6

**Path: 2 Total Path Weight: 40**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18064B	Maintain instrumentation system components	6

MEM18063B	Terminate signal and data cables	4
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**Path: 1 Total Path Weight: 21**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18064B	Maintain instrumentation system components	6
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**Path: 1 Total Path Weight: 24**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18065B	Diagnose and repair digital equipment and components	10
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**Path: 1 Total Path Weight: 30**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18001C	Use hand tools	2
MEM18057B	Maintain/service analog/digital electronic equipment	6

MEM18066B	Diagnose and repair microprocessor-based equipment	6
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**Path: 1 Total Path Weight: 41**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4



MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18065B	Diagnose and repair digital equipment and components	10

MEM18067B	Tune control loops - multi controller or multi element systems	6
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**Path: 1 Total Path Weight: 60**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8

**Path: 2 Total Path Weight: 54**

MEM09002B	Interpret technical drawing	4
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MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18064B	Maintain instrumentation system components	6

MEM18069B	Maintain, repair instrumentation process control analysers	6
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**Path: 1 Total Path Weight: 52**

MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM09002B	Interpret technical drawing	4
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8

**Path: 2 Total Path Weight: 38**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18064B	Maintain instrumentation system components	6

MEM18070C	Modify complex electrical circuits and systems	6
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**Path: 1 Total Path Weight: 61**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18002B	Use power tools/hand held operations	2
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find repair/rectify complex electrical circuits	6

MEM18071B	Connect/disconnect fluid conveying system components	2
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**Path: 1 Total Path Weight: 6**

MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

MEM18072B	Manufacture fluid conveying conductor assemblies	4
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM18073A	Perform advanced equipment testing and diagnostics on mobile plant and equipment	8
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**Path: 1 Total Path Weight: 44**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM16006A	Organise and communicate information	2
MEM16008A	Interact with computing technology	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18010C	Perform equipment condition monitoring and recording	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18084A	Commission and decommission split air conditioning systems	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
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**Path: 1 Total Path Weight: 22**

MEM05006C	Perform brazing and/or silver soldering	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6
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**Path: 1 Total Path Weight: 30**

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

MEM18088B	Maintain and repair commercial air conditioning systems and components	4
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**Path: 1 Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2

MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

MEM18089B	Maintain and repair central air handling systems	6
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

**Path: 2 Total Path Weight: 28**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM18001C	Use hand tools	2

MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

## 1800 Maintenance and diagnostics (Page 5)

Unit code	Unit title	P
MEM18090B	Maintain and repair industrial refrigeration systems and components	6

### Path: 1 Total Path Weight: 40

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10010B	Install pipework and pipework assemblies	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4



MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	4
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**Path: 1 Total Path Weight: 38**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6

**Path: 2 Total Path Weight: 38**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble	3

engineering components

MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18090B	Maintain and repair industrial refrigeration systems and components	6

**Path: 3 Total Path Weight: 36**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18088B	Maintain and repair commercial air conditioning systems and components	4

MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6
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**Path: 1 Total Path Weight: 32**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18088B	Maintain and repair commercial air conditioning systems and components	4

**Path: 2 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18090B	Maintain and repair industrial refrigeration systems and components	6

MEM18093B	Maintain and repair integrated industrial refrigeration and/or large air handling system controls	8
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**Path: 1 Total Path Weight: 42**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18090B	Maintain and repair industrial refrigeration systems and components	6

**Path: 2 Total Path Weight: 42**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18089B	Maintain and repair central air handling systems	6

MEM18094B	Service and repair commercial refrigeration	6
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**Path: 1 Total Path Weight: 34**

MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3

MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

MEM18095A	Maintain and repair cooling towers/evaporative condensers and associated equipment	4
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**Path: 1 Total Path Weight: 34**

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18094B	Service and repair commercial refrigeration	6

**Path: 2 Total Path Weight: 32**

MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4

MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18088B	Maintain and repair commercial air conditioning systems and components	4

MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	6
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**Path: 1 Total Path Weight: 28**

MEM05006C	Perform brazing and/or silver soldering	2
MEM10010B	Install pipework and pipework assemblies	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

MEM18097A	Manufacture cavity dies	8
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**Path: 1 Total Path Weight: 73**

MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07005C	Perform general machining	8

MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12006C	Mark off/out (general engineering)	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18006C	Repair and fit engineering components	6
MEM18015B	Maintain tools and dies	4
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4

MEM18098A	Prepare to perform work associated with fuel system installation and servicing	2
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**Path: 1 Total Path Weight: 6**

MEM09002B	Interpret technical drawing	4
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## 1900 Jewellery Horological

Unit code	Unit title	P
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MEM19001B	Perform jewellery metal casting	6
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**Path: 1 Total Path Weight: 8**

EM13004B	Work safely with molten metals/glass	2
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MEM19002B	Prepare jewellery illustrations	4
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**Path: 1 Total Path Weight: 6**

MEM16006A	Organise and communicate information	2
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MEM19003B	Handle gem materials	2
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MEM19004B	Handle and examine gemstone materials	6
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**Path: 1 Total Path Weight: 8**

MEM19003B	Handle gem materials	2
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MEM19005B	Produce three-dimensional precision items	8
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**Path: 1 Total Path Weight: 20**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM13004B	Work safely with molten metals/glass	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM18003C	Use tools for precision work	4
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MEM19006B	Replace watch batteries	1
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**Path: 1 Total Path Weight: 3**

MEM18001C	Use hand tools	2
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MEM19007B	Perform gemstone setting	6
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**Path: 1 Total Path Weight: 21**

MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM18003C	Use tools for precision work	4
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MEM19003B	Handle gem materials	2
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MEM19008B	Prepare jewellery designs	6
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**Path: 1 Total Path Weight: 24**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM13004B	Work safely with molten metals/glass	2
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MEM16006A	Organise and communicate information	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM18003C	Use tools for precision work	4
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MEM19002B	Prepare jewellery illustrations	4
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**Path: 2 Total Path Weight: 30**

MEM08010B	Manually finish/polish materials	6
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MEM13004B	Work safely with molten metals/glass	2
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MEM16006A	Organise and communicate information	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4

**Path: 3 Total Path Weight: 28**

MEM16006A	Organise and communicate information	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM19003B	Handle gem materials	2
MEM19007B	Perform gemstone setting	6
MEM19014B	Perform hand engraving	4

MEM19009B	Perform investment procedures for lost wax casting process	1
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**Path: 1 Total Path Weight: 8**

MEM12024A	Perform computations	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

**Path: 2 Total Path Weight: 10**

MEM07024B	Operate and monitor machine/process	4
MEM12024A	Perform computations	3
MEM18001C	Use hand tools	2

MEM19010B	Produce rubber moulds for lost wax casting process	2
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MEM19011B	Perform wax injection of moulds for lost wax casting process	2
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MEM19012B	Produce jewellery wax model	4
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**Path: 1 Total Path Weight: 12**

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4

MEM19013B	Produce jewellery metal masters	4
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**Path: 1 Total Path Weight: 20**

MEM08010B	Manually finish/polish materials	6
MEM13004B	Work safely with molten metals/glass	2
MEM16006A	Organise and communicate information	2
MEM19001B	Perform jewellery metal casting	6

MEM19014B	Perform hand engraving	4
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM19015B	Perform jewellery enamelling	4
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**Path: 1 Total Path Weight: 8**

MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2

MEM19016B	Construct jewellery components	4
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**Path: 1 Total Path Weight: 13**

MEM05006C	Perform brazing and/or silver soldering	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM19017B	Fabricate jewellery items	6
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**Path: 1 Total Path Weight: 17**

MEM05006C	Perform brazing and/or silver soldering	2
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2

MEM19018B	Repair jewellery items	6
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**Path: 1 Total Path Weight: 37**

MEM05006C	Perform brazing and/or silver soldering	2
MEM12023A	Perform engineering measurements	5
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM19001B	Perform jewellery metal casting	6
MEM19003B	Handle gem materials	2
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6

MEM19020B	Fault-find and maintain micro-mechanisms	4
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**Path: 1 Total Path Weight: 20**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3

MEM19021B	Diagnose and service micro-mechanisms	6
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**Path: 1 Total Path Weight: 26**

MEM09002B	Interpret technical drawing	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM19020B	Fault-find and maintain micro-mechanisms	4

MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6
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**Path: 1 Total Path Weight: 46**

MEM07005C	Perform general machining	8
MEM09002B	Interpret technical drawing	4
MEM12003B	Perform precision mechanical measurement	2
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM18003C	Use tools for precision work	4
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6

MEM19023A	Apply drawing and rendering techniques to jewellery or object design	4
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MEM19024A	Use CAD to create and display 3D jewellery and object models	4
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MEM19025A	Create and present designs for jewellery and other 3D objects	4
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MEM19026A	Investigate quality and application of jewellery materials	2
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MEM19027A	Produce life drawings for presenting jewellery and object designs	0
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**Path: 1 Total Path Weight: 4**

MEM19023A	Apply drawing and rendering techniques to jewellery or object design	4
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MEM19028A	Select materials and new technologies for jewellery and 3D object design applications	2
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MEM19029A	Produce a professional jewellery design and 3D object portfolio	0
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MEM19030A	Research and design sustainable objects	0
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MEM19031A	Produce renderings and technical drawings for jewellery and object design construction	2
MEM19032A	Design and implement mechanisms in jewellery items	0
MEM19033A	Create silversmithing objects	4
MEM19034A	Apply chain manufacture process	2
MEM19035A	Plan and apply casting techniques for jewellery and object designs	4
MEM19036A	Use specialised techniques to produce jewellery and objects	0
MEM19037A	Plan and implement chenier fabrication process	2
MEM19038A	Apply traditional techniques to jewellery and 3D object production	4
MEM19039A	Plan, conduct and supervise a jewellery and object exhibition	0
MEM19040A	Create and manufacture jewellery or object design prototypes for the mass market	0
MEM19041A	Experiment with jewellery or object designs	0
MEM19042A	Render images using computer graphics software	0

Path: 1 Total Path Weight: 4

MEM19024A	Use CAD to create and display 3D jewellery and object models	4
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MEM19043A	Oversee jewellery or object design production	0
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MEM19044A	Repair and restore antique jewellery	4
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MEM19045A	Set gems in channel style settings	4
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MEM19046A	Apply grain setting techniques	4
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MEM19047A	Set gems in claw and bezel style settings	4
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MEM19048A	Develop and apply complex borders and decorations for hand engraving	4
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MEM19049A	Develop and apply heraldic designs for hand engraving	2
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MEM19050A	Hand carve engraving work	4
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MEM19051A	Construct multiple stone settings	4
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**Path: Total Path Weight: 12**

MEM19045A	Set gems in channel style settings	4
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MEM19047A	Set gems in claw and bezel style settings	4
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MEM19052A	Produce complex objects using silversmithing techniques	4
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MEM19053A	Create complex findings and mechanisms for jewellery items	4
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MEM19054A	Fabricate platinum jewellery items	4
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## 2000 Locksmithing

Unit code	Unit title	P
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MEM20001A	Produce keys	4
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MEM20002A	Assemble and test lock mechanisms	6
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### Path: 1 Total Path Weight: 10

MEM20001A	Produce keys	4
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MEM20003A	Install and upgrade locks and hardware	4
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### Path: 1 Total Path Weight: 8

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM20004A	Gain entry	4
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### Path: 1 Total Path Weight: 22

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM20001A	Produce keys	4
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MEM20002A	Assemble and test lock mechanisms	6
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MEM20003A	Install and upgrade locks and hardware	4
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MEM20005A	Install and maintain door control devices/systems	2
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM20006A	Maintain and service mechanical locking devices	6
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**Path: 1 Total Path Weight: 10**

MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM20007A	Plan and prepare a masterkey system	4
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**Path: 1 Total Path Weight: 14**

MEM20002A	Assemble and test lock mechanisms	6
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MEM20001A	Produce keys	4
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MEM20008A	Develop and implement a masterkey system	6
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**Path: 1 Total Path Weight: 20**

MEM20001A	Produce keys	4
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MEM20002A	Assemble and test lock mechanisms	6
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MEM20007A	Plan and prepare a masterkey system	4
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MEM20009A	Gain entry and reinstate fire and security containers	4
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**Path: 1 Total Path Weight: 14**

MEM18002B	Use power tools/hand held operations	2
MEM20001A	Produce keys	4
MEM20004A	Gain entry	4

MEM20010A	Gain entry and reinstate automotive locking systems	4
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**Path: 1 Total Path Weight: 18**

MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20004A	Gain entry	4

MEM20011A	Service and repair fire and security containers	6
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**Path: 1 Total Path Weight: 20**

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6

MEM20012A	Service and repair mechanical automotive locking systems	4
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**Path: 1 Total Path Weight: 18**

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6

MEM20013A	Service automotive transponder systems	2
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**Path: 1 Total Path Weight: 6**

MEM20001A	Produce keys	4
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MEM20014A	Perform a site security survey	2
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## 2100 Horology

Unit code	Unit title	P
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MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21002A	Perform watch movement exchange	2
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**Path: 1 Total Path Weight: 4**

MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21003A	Perform watch case servicing, repair and refurbishment	4
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**Path: 1 Total Path Weight: 8**

MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21002A	Perform watch movement exchange	2
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MEM21004A	Clean watch and clock components	2
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MEM21005A	Diagnose faults in quartz watches	2
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**Path: 1 Total Path Weight: 4**

MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21006A	Service quartz watches	4
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**Path: 1 Total Path Weight: 10**

MEM21005A	Diagnose faults in quartz watches	2
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MEM21002A	Perform watch movement exchange	2
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MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21007A	Service complex quartz watches	4
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**Path: 1 Total Path Weight: 14**

MEM21006A	Service quartz watches	4
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MEM21005A	Diagnose faults in quartz watches	2
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MEM21002A	Perform watch movement exchange	2
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MEM21001A	Replace watch batteries, capacitors and bands	2
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MEM21008A	Service mechanical watches	4
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
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MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
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**Path: 1 Total Path Weight: 10**

MEM21008A	Service mechanical watches	4
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MEM18001C	Use hand tools	2
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MEM21010A	Service watch power generating systems	2
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**Path: 1 Total Path Weight: 12**

MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21011A	Service calendar and other dial indication mechanisms for watches	4
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**Path: 1 Total Path Weight: 16**

MEM21010A	Service watch power generating systems	2
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21012A	Service and repair mechanical watch oscillating systems	4
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**Path: 1 Total Path Weight: 14**

MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21013A	Service, test and adjust watch escapements	4
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**Path: 1 Total Path Weight: 18**

MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4

MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21014A	Service mechanical chronograph watches	6
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**Path: 1 Total Path Weight: 22**

MEM21011A	Service calendar and other dial indication mechanisms for watches	4
MEM21010A	Service watch power generating systems	2
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21015A	Perform precision watch timing and adjustment	6
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**Path: 1 Total Path Weight: 24**

MEM21013A	Service, test and adjust watch escapements	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21016A	Install and set up clocks	2
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MEM21017A	Service and repair clock timepieces	6
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MEM21018A	Service clock escapements and oscillating systems	4
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**Path: 1 Total Path Weight: 28**

MEM21017A	Service and repair clock timepieces	6
MEM21013A	Service, test and adjust watch escapements	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21008A	Service mechanical watches	4
MEM18001C	Use hand tools	2

MEM21019A	Service and repair clock striking mechanisms	4
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**Path: 1 Total Path Weight: 10**

MEM21017A	Service and repair clock timepieces	6
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MEM21020A	Service and repair clock chiming mechanisms	6
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**Path: 1 Total Path Weight: 16**

MEM21019A	Service and repair clock striking mechanisms	4
MEM21017A	Service and repair clock timepieces	6

MEM21021A	Restore clockwork mechanisms	6
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**Path: 1 Total Path Weight: 30**

MEM21020	Service and repair clock chiming mechanisms	6
MEM21019A	Service and repair clock striking mechanisms	4
MEM21017A	Service and repair clock timepieces	6



MEM18001C	Use hand tools	2
MEM09002B	Interpret technical drawing	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM21022A	Manufacture watch and clock components	6
<b>Path: 1 Total Path Weight: 49</b>		
MEM21021A	Restore clockwork mechanisms	6
MEM21020	Service and repair clock chiming mechanisms	6
MEM21019A	Service and repair clock striking mechanisms	4
MEM21017A	Service and repair clock timepieces	6
MEM18001C	Use hand tools	2
MEM12023A	Perform engineering measurements	5
MEM09002B	Interpret technical drawing	4
MEM07005C	Perform general machining	8
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM21023A	Plan, set up and operate horological workshop or service centre	4

## 2200 Management and Organisation

Unit code	Unit title	P
MEM22001A	Perform engineering activities	0

MEM16006A Organise and communicate information

MEM22002A Manage self in the engineering environment 0

MEM16006A Organise and communicate information

MEM22007A Manage environmental effects of engineering activities 0

MEM16006A Organise and communicate information

MEM22012A Coordinate resources for an engineering project or operation 0

MEM22013A Coordinate engineering projects 0

MEM22014A Coordinate engineering-related manufacturing operations 0

MEM23004A Apply technical mathematics

MEM14091A Integrate manufacturing fundamentals into an engineering task

MEM22015A Source and estimate engineering materials requirements 0

MEM22017A Coordinate continuous improvement and technical development 0

MEM22018A Coordinate sales and promotion of engineering-related products or services 0

## 2300 Engineering Science

Unit code	Unit title	P
MEM23003A	Operate and program computers and/or controllers in engineering situations	0
	MEM16008A Interact with computing technology	
MEM23004A	Apply technical mathematics	0
MEM23005A	Apply statistics and probability techniques to engineering tasks	0
	MEM23004A Apply technical mathematics	
MEM23006A	Apply fluid and thermodynamics principles in engineering	0
	MEM23004A Apply technical mathematics	
MEM23007A	Apply calculus to engineering tasks	0
	MEM23004A Apply technical mathematics	
MEM23008A	Apply advanced algebra and numerical methods to engineering tasks	0
	MEM23004A Apply technical mathematics	
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	0
MEM23063A	Select and test mechanical engineering materials	0
	MEM23004A Apply technical mathematics	
	MEM23109A Apply engineering mechanic principles	

MEM23064A	Select and test mechatronic engineering materials	0
	MEM23004A	Apply technical mathematics
	MEM23109A	Apply engineering mechanic principles
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques	0
	MEA340A	Lay out and set up aircraft systems
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques	0
	MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
MEM23084A	Apply scientific principles and techniques in aeronautical engineering situations	0
	MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
	MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23086A	Apply scientific principles and techniques in avionic engineering situations	0
	MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
MEM23095A	Apply aeronautical system design principles and techniques in aeronautical engineering situations	0
	MEA349A	Apply basic scientific principles and

## techniques in aeronautical engineering

MEM23096A	Apply avionic system design principles and techniques in avionic engineering situations	0
MEA272A	Apply basic scientific principles and techniques in avionic engineering situations	
MEM23097A	Apply automated systems principles and techniques in aeronautical engineering situations	0
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	
MEA349A	Apply basic scientific principles and techniques in aeronautical engineering	
MEM23098A	Apply automated systems principles and techniques in avionic engineering situations	0
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	
MEM23109A	Apply engineering mechanics principles	0
MEM23004A	Apply technical mathematics	
MEM23111A	Select electrical equipment and components for engineering applications	0
MEM23004A	Apply technical mathematics	
MEM23112A	Investigate electrical and electronic controllers in engineering applications	0
MEM23004A	Apply technical mathematics	

MEM23111A      Select electrical equipment and components  
for engineering applications

MEM23113A      Evaluate hydrodynamic systems and system components      0

MEM23004A      Apply technical mathematics

MEM23006A      Apply fluid and thermodynamics principles  
in engineering

MEM23114A      Evaluate thermodynamic systems and components      0

MEM23004A      Apply technical mathematics

MEM23006A      Apply fluid and thermodynamics principles  
in engineering

MEM23115A      Evaluate fluid power systems      0

MEM23004A      Apply technical mathematics

MEM23006A      Apply fluid and thermodynamics principles  
in engineering

MEM23116A      Evaluate programmable logic controller and related control  
system component applications      0

MEM23004A      Apply technical mathematics

MEM23111A      Select electrical equipment and components  
for engineering applications

MEM23112A      Investigate electrical and electronic  
controllers in engineering applications

MEM23117A      Evaluate microcontroller applications      0

MEM23004A      Apply technical mathematics

MEM23111A      Select electrical equipment and components

	for engineering applications	
MEM23112A	Investigate electrical and electronic controllers in engineering applications	
MEM23118A	Apply production and service control techniques	0
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	
MEM23119A	Evaluate continuous improvement processes	0
MEM23118A	Apply production and service control techniques	
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	
MEM23120A	Select mechanical machine and equipment components	0
MEM23004A	Apply technical mathematics	
MEM23109A	Apply engineering mechanic principles	
MEM23121A	Analyse loads on frames and mechanisms	0
MEM23004A	Apply technical mathematics	
MEM23007A	Apply calculus to engineering tasks	
MEM23109A	Apply engineering mechanics principles	
MEM23122A	Evaluate computer integrated manufacturing systems	0
MEM23004A	Apply technical mathematics	
MEM23111A	Select electrical equipment and components for engineering applications	

MEM23112A	Investigate electrical and electronic controllers in engineering applications	
MEM23123A	Evaluate manufacturing processes	0
MEM23124A	Measure and analyse noise and vibration	0
MEM23004A	Apply technical mathematics	
MEM23125A	Evaluate maintenance systems	0
MEM23004A	Apply technical mathematics	
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications	
MEM14092A	Integrate maintenance fundamentals into an engineering task	
MEM23126A	Evaluate industrial robotic applications	0
MEM23004A	Apply technical mathematics	
MEM23111A	Select electrical equipment and components for engineering applications	
MEM23112A	Investigate electrical and electronic controllers in engineering applications	
MEM23116A	Evaluate programmable logic controller and related control system component applications	
MEM23117A	Evaluate microcontroller applications	
MEM23129A	Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration	0
MEM23004A	Apply technical mathematics	



	MEM23006A	Apply fluid and thermodynamics principles in engineering	
MEM23130A	Coordinate servicing and fault-finding of HVACR control systems		0
	MEM23004A	Apply technical mathematics	
	MEM23006A	Apply fluid and thermodynamics principles in engineering	
MEM23131A	Evaluate rapid prototyping applications		0
	MEM23004A	Apply technical mathematics	
MEM23132A	Evaluate rapid manufacturing processes		0
	MEM23004A	Apply technical mathematics	
MEM23133A	Evaluate rapid tooling applications		0
	MEM23004A	Apply technical mathematics	
MEM23134A	Evaluate jigs and fixtures		0
	MEM23004A	Apply technical mathematics	
	MEM23109A	Apply engineering mechanic principles	
MEM23135A	Evaluate moulding tools and processes		0
	MEM23004A	Apply technical mathematics	
MEM23136A	Evaluate stamping and forging tools		0
	MEM23004A	Apply technical mathematics	

MEM23109A Apply engineering mechanic principles

MEM23137A Evaluate rolling tools and processes 0

MEM23004A Apply technical mathematics

MEM23109A Apply engineering mechanic principles

MEM23138A Evaluate suitability of materials for engineering-related applications 0

MEM23004A Apply technical mathematics

MEM23139A Design a basic single zone duct distribution system 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

MEM30033A Use computer-aided design (CAD) to create and display 3-D models

MEM23140A Determine operational parameters for building HVAC hydronic systems 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23141A Complete a building thermal performance survey 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23142A Determine psychrometric processes and system performance

MEM23142A Determine psychrometric processes and system performance 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23143A Apply energy management principles 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23144A Contribute to the design of a commercial refrigeration system 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23129A Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration

MEM23145A Apply codes and regulations to air conditioning designs 0

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

MEM23140A Determine operational parameters for building HVAC/R hydronic systems

MEM23142A Determine psychrometric processes and system performance

MEM23146A	Contribute to the design of industrial refrigeration systems	0
	MEM23004A	Apply technical mathematics
	MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23147A	Contribute to the design of hydronic systems	0
	MEM23004A	Apply technical mathematics
	MEM23006A	Apply fluid and thermodynamics principles in engineering
	MEM23140A	Determine operational parameters for building HVAC/R hydronic systems
MEM23148A	Develop energy management solutions	0
	MEM23004A	Apply technical mathematics
	MEM23006A	Apply fluid and thermodynamics principles in engineering
	MEM23142A	Apply psychrometric processes and system performance
	MEM23143A	Apply energy management principles
	MEM23154A	Analyse and service heating, ventilation, airconditioning and refrigeration control systems
MEM23149A	Contribute to the design of commercial and industrial exhaust systems	0
	MEM23004A	Apply technical mathematics
MEM23150A	Contribute to the design of heating systems	0
	MEM23004A	Apply technical mathematics

MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23140A	Determine operational parameters for building HVAC/R hydronic systems
MEM23147A	Contribute to the design of hydronic systems

MEM23151A	Commission and optimise performance of HVACR systems	0
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MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23154A	Analyse and service HVAC/R control systems
MEM23140A	Determine operational parameters for building HVAC hydronic systems

MEM23152A	Apply principles of refrigeration food storage technology	0
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MEM23153A	Contribute to the design of heat exchanger systems	0
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MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering

MEM23154A	Analyse and service HVACR systems	0
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MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering

## 2340 Engineering Practice

Unit code	Unit title	P
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MEM234001A	Plan and manage engineering-related projects or operations	0
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MEM234002A	Integrate engineering technologies	0
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MEM234003A	Design machines and ancillary equipment	0
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MEM234004A	Design for engineering-related noise and vibration mitigation	0
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MEM234005A	Design hydrodynamic pumping systems	0
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MEM234006A	Evaluate and select thermodynamic systems or subsystems	0
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MEM234007A	Design fluid power systems	0
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MEM234008A	Design plant using computer simulations	0
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MEM234009A	Design computer-integrated manufacturing systems	0
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MEM234010A	Design microcontroller applications	0
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MEM234011A	Design programmable logic controller applications	0
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MEM234012A	Design integrated maintenance management systems	0
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MEM234013A	Plan and design engineering-related manufacturing processes	0
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MEM234014A	Design a robotic system	0
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MEM234015A	Design hydronic heat exchanger systems	0
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MEM234016A	Design refrigeration systems	0
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MEM234017A	Design exhaust, ventilation and dust collection systems	0
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MEM234018A	Design heating, ventilation, air conditioning and refrigeration control systems	0
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MEM234019A	Apply finite element analysis in engineering design	0
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MEM234020A	Coordinate small lot manufacture using rapid manufacture processes	0
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MEM234021A	Apply statistics to technology problems	0
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MEM234022A	Apply advanced calculus to technology problems	0
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MEM234023A	Apply differential equations to technology problems	0
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MEM234024A	Apply advanced mathematics in technology problems	0
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MEM234025A	Apply numerical methods to technology problems	0
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MEM234026A	Develop and coordinate engineering-related contingency plans	0
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MEM234027A	Plan and manage materials supply for an engineering project or manufacturing operation	0
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MEM234028A	Produce and manage technical documentation	0
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MEM234029A	Produce and manage technical publications	0
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MEM234030A	Provide specialised technical and engineering guidance to other technical employees	0
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MEM234031A	Manage installation, commissioning or modification of machines and equipment	0
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MEM234032A	Manage fluid power related technologies in an enterprise	0
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MEM234033A	Lead engineering-related quality operations in an enterprise	0
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MEM234034A	Manage heating, ventilation, air conditioning and refrigeration systems or projects	0
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MEM234035A	Maintain and apply technical and engineering skills	0
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MEM234036A	Apply configuration management procedures in engineering project management	0
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MEM23003A	Operate and program computers and/or controllers in engineering situations
MEM234028A	Produce and manage technical documentation
MEM234029A	Produce and manage technical publications

MEM234037A	Perform maintenance-related integrated logistic support management activities	0
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MEM23003A	Operate and program computers and/or controllers in engineering situations
MEM234028A	Produce and manage technical documentation
MEM234029A	Produce and manage technical publications

MEM234038A	Apply systems engineering procedures to engineering design project management	0
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## 2400 Non destructive testing

Unit code	Unit title	P
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MEM24001B	Perform basic penetrant testing	2
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### Path: 1 Total Path Weight: 4

MEM18001C	Use hand tools	2
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MEM24002B	Perform penetrant testing	4
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### Path: 1 Total Path Weight: 10

MEM18001C	Use hand tools	2
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MEM24012C	Apply metallurgy principles	4
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MEM24003B	Perform basic magnetic particle testing	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM24004B	Perform magnetic particle testing	4
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**Path: 1 Total Path Weight: 10**

MEM18001C	Use hand tools	2
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MEM24012C	Apply metallurgy principles	4
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MEM24005B	Perform basic eddy current testing	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM24006B	Perform eddy current testing	6
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**Path: 1 Total Path Weight: 12**

MEM18001C	Use hand tools	2
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MEM24012C	Apply metallurgy principles	4
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MEM24007B	Perform ultrasonic thickness testing	2
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**Path: 1 Total Path Weight: 4**

MEM18001C	Use hand tools	2
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MEM24008B	Perform ultrasonic testing	6
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**Path: 1 Total Path Weight: 12**

MEM18001C	Use hand tools	2
MEM24012C	Apply metallurgy principles	4

MEM24009B	Perform basic radiographic testing	2
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**Path: 1 Total Path Weight: 8**

MEM13013B	Work safely with ionizing radiation	4
MEM18001C	Use hand tools	2

MEM24010B	Perform radiographic testing	6
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**Path: 1 Total Path Weight: 16**

MEM13013B	Work safely with ionizing radiation	4
MEM18001C	Use hand tools	2
MEM24012C	Apply metallurgy principles	4

MEM24011B	Establish non-destructive tests	12
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**Path: 1 Total Path Weight: 50**

MEM13013B	Work safely with ionizing radiation	4
MEM16010A	Write reports	2
MEM18001C	Use hand tools	2
MEM24002B	Perform penetrant testing	4
MEM24004B	Perform magnetic particle testing	4
MEM24006B	Perform eddy current testing	6
MEM24008B	Perform ultrasonic testing	6
MEM24010B	Perform radiographic testing	6
MEM24012C	Apply metallurgy principles	4

MEM24012C	Apply metallurgy principles	4
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## 2500 Marine Craft Construction

Unit code	Unit title	P
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MEM25001B	Apply fibre-reinforced materials	2
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### Path: 1 Total Path Weight: 8

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25002B	Form and integrate fibre-reinforced structures	4
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### Path: 1 Total Path Weight: 10

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25003B	Set up marine vessel structures	4
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### Path: 1 Total Path Weight: 21

MEM09002B	Interpret technical drawing	4
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MEM12007D	Mark off/out structural fabrications and shapes	4
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MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25004B	Fair and shape surfaces	2
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**Path: 1 Total Path Weight: 8**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25005B	Construct and assemble marine vessel timber components	8
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**Path: 1 Total Path Weight:29**

MEM04018B	Perform general woodworking machine operations	4
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MEM09002B	Interpret technical drawing	4
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MEM12007D	Mark off/out structural fabrications and shapes	4
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MEM12023A	Perform engineering measurements	5
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25006B	Undertake marine sheathing operations	2
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**Path: 1 Total Path Weight: 10**

MEM13003B	Work safely with industrial chemicals and materials	2
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MEM18001C	Use hand tools	2
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MEM18002B	Use power tools/hand held operations	2
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MEM25004B	Fair and shape surfaces	2
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MEM25007B	Maintain marine vessel surfaces	4
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**Path: 1 Total Path Weight: 10**

MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM25008B	Repair marine vessel surfaces and structures	4
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**Path: 1 Total Path Weight: 25**

MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5
MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM25004B	Fair and shape surfaces	2
MEM25007B	Maintain marine vessel surfaces	4

MEM25009B	Form timber shapes using hot processes	2
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**Path: 1 Total Path Weight: 23**

MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM25010B	Perform fitout procedures	4
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**Path: 1 Total Path Weight: 33**

MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM25005B	Construct and assemble marine vessel timber components	8

MEM25011B	Install marine systems	8
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**Path: 1 Total Path Weight: 12**

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM25012B	Install and test operations of marine auxiliary systems	6
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**Path: 1 Total Path Weight: 12**

MEM13003B	Work safely with industrial chemicals and materials	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM25013B	Produce three-dimensional plugs/moulds	12
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**Path: 1 Total Path Weight: 41**

MEM04018B	Perform general woodworking machine operations	4
MEM09002B	Interpret technical drawing	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12023A	Perform engineering measurements	5
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4

MEM25014B	Perform marine slipping operations	2
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**Path: 1 Total Path Weight: 6**

MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2

MEM25015A	Assemble and install equipment and accessories/ancillaries	2
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**Path: 1 Total Path Weight: 10**

MEM09002B	Interpret technical drawing	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2



## 2600 Composites

Unit code	Unit title	P
MEM26001A	Lay up composites using open moulding techniques	6
MEM26002A	Lay up composites using vacuum closed moulding techniques	6
MEM26003A	Lay up composites using pressure closed moulding techniques	6
MEM26004A	Make basic plugs for composites fabrication	3
MEM26005A	Make basic moulds for composites fabrication	3
MEM26006A	Mark and cut out sheets for composite use	4
MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4
MEM26009A	Select and use cores and fillers appropriate for product	2
MEM26010A	Store and handle composite materials	2
MEM26011A	Determine materials and techniques for a composite component or product	6

**Path 1: Total path weight: 20**

MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4
MEM26009A	Select and use cores appropriate for product	2
MEM09002B	Interpret technical drawing	4
MEM26012A	Record and trial work processes for one-off composite products	4
MEM26013A	Select and use composite processes or systems appropriate for product	4
MEM26014A	Adjust resin chemicals for current conditions	4
MEM26015A	Select and apply repair techniques	6
MEM26016A	Select and use joining techniques	6
MEM26017A	Prepare composite or other substrate surfaces	4
MEM26018A	Organise composite trials	4
MEM26019A	Finish a composite product	4
MEM26020A	Identify and interpret required standards for composites	2

## 3000 Engineering Technician

Unit code	Unit title	P
MEM30005A	Calculate force systems within simple beam structures	0
	MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment	
MEM30006A	Calculate stresses in simple structures	0
	MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment	
MEM30007A	Select common engineering materials	0
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications	0
MEM30009A	Contribute to the design of basic mechanical systems	0
	MEM16008A Interact with computing technology	
	MEM30002A Produce basic engineering graphics	
	MEM30003A Produce detailed engineering drawings	
MEM30010A	Set up basic hydraulic circuits	0
MEM30011A	Set up basic pneumatic circuits	0
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	0

MEM30013A	Assist in the preparation of a basic workplace layout	0
MEM30014A	Apply basic just in time systems to the reduction of waste	0
MEM30015A	Develop recommendations for basic set up time improvements	0
MEM30016A	Assist in the analysis of a supply chain	0
MEM30017A	Use basic preventative maintenance techniques and tools	0
MEM30018A	Undertake basic process planning	0
MEM30019A	Use resource planning software systems in manufacturing	0
	MEM16008A Interact with computing technology	
MEM30020A	Develop and manage a plan for a simple manufacturing related project	0
MEM30021A	Prepare a simple production schedule	0
MEM30022A	Undertake supervised procurement activities	0
MEM30023A	Prepare a simple cost estimate for a manufactured product	0
MEM30024A	Participate in quality assurance techniques	0

MEM15001B Perform basic statistical quality control

MEM30025A Analyse a simple electrical system circuit 0

MEM12024A Perform computations

MEM30026A Select and test components for simple electronic switching and timing circuits 0

MEM12024A Perform computations

MEM30027A Prepare basic programs for programmable logic controllers 0

MEM30028A Assist in sales of technical products/systems 0

MEM30029A Use workshop equipment and processes to complete an engineering project 0

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements 0

MEM30032A Produce basic engineering drawings 0

MEM30033A Use computer-aided design (CAD) to create and display 3-D models 0

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

## 5000 Boating services

Unit code	Unit title	P
MEM50001B	Classify recreational boating technologies and features	0

MEM50002B	Work safely on marine craft	1
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MEM50003B	Follow work procedures to maintain the marine environment	1
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MEM50004B	Maintain quality of environment by following marina codes	1
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### Path: 1 Total Path Weight: 2

MEM50003B	Follow work procedures to maintain the marine environment	1
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MEM50005B	Refuel vessels
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### Path: 1 Total Path Weight: 2

MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1

MEM50006B	Check operational capability of marine craft
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### Path: 1 Total Path Weight: 1

MEM50002B	Work safely on marine craft	1
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MEM50007B	Check operational capability of sails and sail operating equipment
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### Path: 1 Total Path Weight: 1

MEM50002B	Work safely on marine craft	1
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MEM50008B	Carry out trip preparation and planning
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MEM50009B	Safely operate a mechanically powered recreational boat	2
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MEM50010B	Respond to boating emergencies and incidents
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## Pre-employment

Code	Title	P
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MEMPE001A	Use engineering workshop machines	0
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MEMPE002A	Use electric welding machines	0
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MEMPE003A	Use oxy-acetylene and soldering equipment	0
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MEMPE004A	Use fabrication equipment	0
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MEMPE005A	Develop a career plan for the engineering and manufacturing industry	0
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MEMPE006A	Undertake a basic engineering project	0
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MEMPE007A	Pull apart and re-assemble engineering mechanisms	0
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## Appendix 2: Certificate III Trade Specialisation Units

Units from the Trade Specialisation units list below may be selected to bring the total value of Stream and Specialisation units to at least 73 points, including any prerequisites for the following certificates:

MEM30205 Certificate III in Engineering - Mechanical Trade

MEM30305 Certificate III in Engineering - Fabrication Trade

MEM30405 Certificate III in Engineering - Electrical/Electronic Trade

MEM30605 Certificate III in Jewellery Manufacture

MEM30705 Certificate III in Marine Craft Construction

MEM30805 Certificate III in Locksmithing

MEM31010 Certificate III in Watch and Clock Service and Repair

### Specialisation units

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4



Unit code	Unit title	P
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2
MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04016C	Develop and manufacture precision models	6
MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	4
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM04020A	Supervise individual ferrous melting and casting operation	4
MEM04021A	Supervise individual non ferrous melting and casting operation	4
MEM04022A	Examine appropriateness of methoding for mould design	4
MEM04023A	Undertake prescribed tests on foundry related materials	4
MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2

Unit code	Unit title	P
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	2
MEM05009C	Perform automated thermal cutting	2
MEM05010C	Apply fabrication, forming and shaping techniques	8
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4
MEM05018C	Perform advanced welding using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
MEM05022C	Perform advanced welding using oxy acetylene welding process	6
MEM05023C	Weld using submerged arc welding process	4
MEM05027A	Perform aluminothermic welding	2
MEM05036C	Repair/replace/modify fabrications	4
MEM05037C	Perform geometric development	6
MEM05038B	Perform advanced geometric development – cylindrical/rectangular	2

Unit code	Unit title	P
MEM05039B	Perform advanced geometric development – conical	2
MEM05040B	Perform advanced geometric development – transitions	4
MEM05041B	Weld using powder flame spraying	4
MEM05047B	Weld using flux core arc welding process	4
MEM05048B	Perform advanced welding using flux core arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM05054A	Write basic NC/CNC programs for thermal cutting machines	4
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07002B	Perform precision shaping/planing/slotting operations	4
MEM07003B	Perform machine setting (routine)	4

Unit code	Unit title	P
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM07009B	Perform precision jig boring operations	4
MEM07010B	Perform tool and cutter grinding operations	4
MEM07011B	Perform complex milling operations	4
MEM07012B	Perform complex grinding operations	4
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
MEM07021B	Perform complex lathe operations	4
MEM07022C	Program CNC wire cut machines	2
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2

Unit code	Unit title	P
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1

Unit code	Unit title	P
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09005B	Perform basic engineering detail drafting	8
MEM09011B	Apply basic engineering design concepts	6
MEM09021B	Interpret and produce curved 3-dimensional shapes	4
MEM09022A	Create 2D code files using computer aided manufacturing system	4
MEM10001C	Erect structures	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM10004B	Enter and change programmable controller operational parameters	2
MEM10005B	Commission programmable controller programs	4
MEM10006B	Install machine/plant	4
MEM10009B	Install refrigeration and air conditioning plant and equipment	4
MEM10010B	Install pipework and pipework assemblies	4
MEM10011B	Terminate and connect specialist cables	3
MEM10013A	Install split air conditioning systems and associated pipework	6
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4

Unit code	Unit title	P
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/movable load shifting equipment	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4

Unit code	Unit title	P
MEM12006C	Mark off/out (general engineering)	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12019B	Measure components using coordinate measuring machine	4
MEM12020B	Set and operate coordinate measuring machine	2
MEM12021B	Program coordinate measuring machine	4
MEM12022B	Program coordinate measuring machine (advanced)	2
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise	4
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM13010A	Supervise occupational health and safety in an industrial work environment.	4
MEM13013B	Work safely with ionizing radiation	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM15015B	Examine trading practices	5
MEM15016B	Inspect pre-packed articles	8
MEM15022B	Verify reference standards	8



Unit code	Unit title	P
MEM16001B	Give formal presentations and take part in meetings	2
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16011A	Communicate with individuals and small groups	2
MEM16013A	Operate in a self-directed team	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18004B	Maintain and overhaul mechanical equipment	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
MEM18008B	Balance equipment	2
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18011C	Shut down and isolate machines/equipment	2
MEM18012B	Perform installation and removal of mechanical seals	2
MEM18013B	Perform gland packing	2
MEM18014B	Manufacture press tools and gauges	8

Unit code	Unit title	P
MEM18015B	Maintain tools and dies	4
MEM18018C	Maintain pneumatic system components	4
MEM18019B	Maintain pneumatic systems	4
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18031B	Diagnose and rectify low voltage starting systems	2
MEM18032B	Maintain induction/exhaust systems	4
MEM18033B	Perform engine bottom-end overhaul	4
MEM18034B	Perform engine top-end overhaul	8
MEM18035B	Diagnose and rectify braking systems	6
MEM18037B	Diagnose and rectify low voltage charging systems	2
MEM18038B	Maintain wheels and tyres	2
MEM18039B	Diagnose and rectify track type undercarriage	4
MEM18040B	Maintain suspension systems	4
MEM18041B	Maintain steering systems	4
MEM18042C	Diagnose and rectify manual transmissions	4

Unit code	Unit title	P
MEM18043C	Diagnose and rectify automatic transmissions	8
MEM18044C	Diagnose and rectify drive line and final drives	4
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
MEM18052B	Maintain fluid power systems for mobile plant	4
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18058C	Modify electronic equipment	4
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18063B	Terminate signal and data cables	4
MEM18064B	Maintain instrumentation system components	6
MEM18065B	Diagnose and repair digital equipment and components	10

Unit code	Unit title	P
MEM18066B	Diagnose and repair microprocessor-based equipment	6
MEM18067B	Tune control loops – multi controller or multi element systems	6
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6
MEM18088B	Maintain and repair commercial air conditioning systems and components	4
MEM18089B	Maintain and repair central air handling systems	6
MEM18090B	Maintain and repair industrial refrigeration systems and components	6
MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	4
MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6
MEM18094B	Service and repair commercial refrigeration	6
MEM18095A	Maintain and repair cooling towers/evaporative condensers and associated equipment	4
MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	6
MEM18097A	Manufacture cavity dies	8
MEM18098A	Prepare to perform work associated with fuel system installation and servicing	2
MEM19001B	Perform jewellery metal casting	6

Unit code	Unit title	P
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19008B	Prepare jewellery designs	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19013B	Produce jewellery metal masters	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19018B	Repair jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6
MEM20001A	Produce Keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4

Unit code	Unit title	P
MEM20005A	Install and maintain door control devices/systems	2
MEM20006A	Maintain and service mechanical locking devices	6
MEM20007A	Plan and prepare a masterkey system	4
MEM20008A	Develop and implement a masterkey system	6
MEM20009A	Gain entry and reinstate fire and security containers	4
MEM20010A	Gain entry and reinstate automotive locking systems	4
MEM20011A	Service and repair fire and security containers	6
MEM20012A	Service and repair mechanical automotive locking systems	4
MEM20013A	Service automotive transponder systems	2
MEM20014A	Perform a site security survey	2
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange	2
MEM21003A	Perform watch case servicing, repair and refurbishment	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches	2
MEM21006A	Service quartz watches	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21010A	Service watch power generating systems	2
MEM21011A	Service calendar and other dial indication mechanisms for watches	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21013A	Service, test and adjust watch escapements	4

Unit code	Unit title	P
MEM21014A	Service mechanical chronograph watches	6
MEM21015A	Perform precision watch timing and adjustment	6
MEM21016A	Install and set up clocks	2
MEM21017A	Service and repair clock timepieces	6
MEM21018A	Service clock escapements and oscillating systems	4
MEM21019A	Service and repair clock striking mechanisms	4
MEM21020A	Service and repair clock chiming mechanisms	6
MEM21021A	Restore clockwork mechanisms	6
MEM21022A	Manufacture watch and clock components	6
MEM21023A	Plan, set up and operate horological workshop or service centre	4
MEM24001B	Perform basic penetrant testing	2
MEM24002B	Perform penetrant testing	4
MEM24003B	Perform basic magnetic particle testing	2
MEM24004B	Perform magnetic particle testing	4
MEM24005B	Perform basic eddy current testing	2
MEM24006B	Perform eddy current testing	6
MEM24007B	Perform ultrasonic thickness testing	2
MEM24008B	Perform ultrasonic testing	6
MEM24009B	Perform basic radiographic testing	2
MEM24010B	Perform radiographic testing	6
MEM24012C	Apply metallurgy principles	4
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4

Unit code	Unit title	P
MEM25004B	Fair and shape surfaces	2
MEM25005B	Construct and assemble marine vessel timber components	8
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25008B	Repair marine vessel surfaces and structures	4
MEM25009B	Form timber shapes using hot processes	2
MEM25010B	Perform fitout procedures	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25013B	Produce three-dimensional plugs/moulds	12
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM26001A	Lay up composites using open moulding techniques	0
MEM26002A	Lay up composites using vacuum closed moulding techniques	0
MEM26003A	Lay up composites using pressure closed moulding techniques	0
MEM26004A	Make basic plugs for composites fabrication	0
MEM26005A	Make basic moulds for composites fabrication	0
MEM26006A	Mark and cut out sheets for composite use	0
MEM26007A	Select and use reinforcing appropriate for product	0
MEM26008A	Select and use resin systems appropriate for product	0
MEM26009A	Select and use cores and fillers appropriate for product	0
MEM26010A	Store and handle composite materials	0
MEM26011A	Determine materials and techniques for a composite component or product*	0



Unit code	Unit title	P
MEM26012A	Record and trial work processes for one-off composite products	0
MEM26013A	Select and use composite processes or systems appropriate for product	0
MEM26014A	Adjust resin chemicals for current conditions	0
MEM26015A	Select and apply repair techniques	0
MEM26016A	Select and use joining techniques	0
MEM26017A	Prepare composite or other substrate surfaces	0
MEM26018A	Organise composite trials	0
MEM26019A	Finish a composite product	0
MEM26020A	Identify and interpret required standards for composites	0
MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment	4
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2
AURV225908A	Carry out panel repairs	4
ICTTC136B	Install, maintain and modify customer premises communications cabling: ACA Restricted Rule	6
ICTTC137B	Install, maintain and modify customer premises communications cabling: ACA Open Rule	6
MSAENV472B	Implement and monitor environmentally sustainable work practices	4
MSATCM304A	Interpret basic binary phase diagrams	4
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2

Unit code	Unit title	P
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-pregs	4
PRSTS202A	Install security equipment/system	4
PRSTS302A	Program security equipment/system	2
PRSTS303A	Test installed security equipment/system	2
PRSTS304A	Commission/decommission security equipment/system	2
PRSTS305A	Identify and diagnose electronic security equipment/ system fault	2
PRSTS307A	Maintain and service security equipment/system	4
PRSTS317A	Provide estimate and quote	4
PRSTS319A	Modify and repair security equipment/system	4
TLILIC2001A	Licence to operate a forklift truck	0
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1

### Appendix 3: Imported units of competency and points weighting

The table below shows imported units of competency and, where applicable, their allocated points weighting. Unit points weightings are shown in the right hand column labelled "P".

#### Training Package codes for imported units:

AUR05	Automotive Industry Retail, Service and Repair Training Package
BSB07	Business Services Training Package
CPC08	Construction, Plumbing and Services Integrated Framework
CUF07	Screen and Media Training Package

CUV11	Visual Arts, Craft and Design Training Package
ICT02	Telecommunications Training Package
LMF02	Furnishing Training Package
MEA11	Aeroskills Training Package
MSA07	Manufacturing Training Package
MSL09	Laboratory Training Package
PMB07	Plastics, Rubber and Cablemaking Training Package
PRS03	Asset Security Training Package
SIR07	Retail Services Training Package
TLI10	Transport and Logistics Training Package
UEP06	Electricity Supply Industry Training Package

Unit code	Unit title	P
AURV225908A	Carry out panel repairs	4
BSBCMM401A	Make a presentation	
BSBCRT401A	Articulate, present and debate ideas	
BSBCRT402A	Collaborate in a creative process	
BSBCRT501A	Originate and develop concepts	
BSBCRT601A	Research and apply concepts and theories of creativity	
BSBDES402A	Interpret and respond to a design brief	
BSBDES502A	Establish, negotiate and refine a design brief	
BSBDES601A	Manage design realisation	
BSBDES602A	Research global design trends	
BSBDES701A	Research and apply design theory	
BSBIPR401A	Use and respect copyright	

BSBIPR501A	Manage intellectual property to protect and grow business	
BSBLED705A	Plan and implement a mentoring program	
BSBLED706A	Plan and implement a coaching strategy	
BSBLED710A	Develop human capital	
BSBPMG510A	Undertake project work	
BSBREL701A	Develop and cultivate collaborative partnerships and relationships	
BSBSMB403A	Market the small business	4
BSBSMB405B	Monitor and manage small business operations	4
BSBSMB406A	Manage small business finances	4
CPCCLDG3001A	Licence to perform dogging	
CPCCLRG3001A	Licence to perform rigging basic level	
CPCCLSF2001A	Licence to erect, alter and dismantle scaffolding basic level	
CPCCLSF3001A	Licence to erect, alter and dismantle scaffolding intermediate level	
CPCCOHS1001A	Work safely in the construction industry	
CPCPCM4002A	Estimate and cost work	
CPPBDN5013A	Develop and collaborate on building information models for small-scale building design projects	
CUFIND201A	Develop and apply creative arts industry knowledge	
CUFRES401A	Conduct research	
CUVACD304A	Make scale models	
CUVACD504A	Research and apply light and colour	
CUVACD506A	Refine 2-D design ideas and processes	
CUVACD507A	Refine 3-D design ideas and processes	
CUVACD512A	Work with photomedia in creative practice	

CUVACD601A	Extend professional expertise with drawing and other visual representation tools	
CUVDES403A	Research and apply techniques for the design of wearable objects	
CUVDIG401A	Experiment with techniques to enhance digital images	
CUVDIG501A	Refine digital art techniques	
CUVDRA501A	Refine drawing techniques	
CUVDRA502A	Investigate drawing materials and processes	
CUVGRD301A	Prepare files for publication	
CUVJWL401A	Experiment with techniques to produce jewellery	
CUVPHI302A	Capture photographic images	
CUVPHI403A	Apply photo imaging lighting techniques	
CUVPRP403A	Select and organise finished work for storage	
CUVPRP405A	Develop and discuss ideas for own creative work	
CUVPRP501A	Realise a body of creative work	
CUVPRP502A	Prepare for sustainable professional practice	
CUVPRP503A	Present a body of own creative work	
CUVPRP601A	Originate a body of independent creative work	
CUVPRP602A	Collaborate in professional creative projects	
CUVPRP603A	Engage in the business of creative practice	
CUVPRP604A	Publicly present a body of own creative work	
CUVRES502A	Analyse cultural history and theory	
CUVRES601A	Extend cultural research expertise	
FDFOP2005A	Work in a socially diverse environment	
ICTTC136B	Install, maintain and modify customer premises communications cabling: ACA Restricted Rule	6

ICTTC137B	Install, maintain and modify customer premises communications cabling: ACA Open Rule	6
LMFFDT4012A	Produce ideation drawings	
LMTGN4002A	Participate in product engineering	
LMTGN4002A	Participate in product engineering	
MEA101B	Interpret occupational health and safety practices in aviation maintenance	
MEA105C	Apply quality standards applicable to aviation maintenance processes	
MEA107B	Interpret and use aviation maintenance industry manuals and specifications	
MEA108B	Complete aviation maintenance industry documentation	
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance	
MEA270A	Lay out avionic systems	
MEA271A	Lay out avionic flight management systems	
MEA272B	Apply basic scientific principles and techniques in avionic engineering situations	
MEA273A	Select and test avionic engineering materials	
MEA340A	Lay out and set up aircraft systems	
MEA341A	Apply basic aircraft design characteristics	
MEA342A	Apply basic aircraft power plant design characteristics	
MEA349B	Apply basic scientific principles and techniques in aeronautical engineering situations	
MEA350A	Select and test aeronautical engineering materials	
MSAENV272B	Participate in environmentally sustainable work practices	3
MSAENV472B	Implement and monitor environmentally sustainable work practices	4
MSAENV672B	Develop workplace policy and procedures for environmental	

	sustainability	
MSAPCI101A	Adapt to work in industry	
MSAPMSUP106A	Work in a team	
MSATCM304A	Interpret basic binary phase diagrams	4
MSATCS301A	Interpret architectural and design specifications for structural steel detailing	
MSATCS302A	Detail bolts and welds for structural steelwork connections	
MSATCS501A	Detail standardised structural connections	
MSATCS502A	Detail structural steel members	
MSATCS503A	Incorporate structural steel detailing into fabrication and construction project management	
MSATCS504A	Detail ancillary steelwork	
MSL976003A	Evaluate and select appropriate test methods and procedures	
MSS402002A	Sustain process improvements	
MSS402030A	Apply cost factors to work practices	
MSS402051A	Apply quality standards	
MSS402060A	Use planning software systems in operations	
MSS402061A	Use SCADA systems in operations	
MSS402080A	Undertake root cause analysis	
MSS403001A	Implement competitive systems and practices	
MSS403002A	Ensure process improvements are sustained	
MSS403010A	Facilitate change in an organisation implementing competitive systems and practices	
MSS403021A	Facilitate a Just in Time system	
MSS403023A	Monitor a levelled pull system of operations	
MSS403030A	Improve cost factors in work practices	
MSS403032A	Analyse manual handling processes	

MSS403040A	Facilitate and improve implementation of 5S	
MSS403051A	Mistake proof an operational process	
MSS404050A	Undertake process capability improvements	
MSS404052A	Apply statistics to operational processes	
MSS404060A	Facilitate the use of planning software systems in a work area or team	
MSS404061A	Facilitate the use of SCADA systems in a team or work area	
MSS404081A	Undertake proactive maintenance analyses	
MSS404082A	Assist in implementing a proactive maintenance strategy	
MSS405001A	Develop competitive systems and practices for an organisation	
MSS405002A	Analyse and map a value stream	
MSS405003A	Manage a value stream	
MSS405004A	Develop business plans in an organisation implementing competitive systems and practices	
MSS405005A	Manage competitive systems and practices in an organisation responding to individual and unique customer orders	
MSS405007A	Introduce competitive systems and practices to a small or medium enterprise	
MSS405010A	Manage relationships with non-customer external organisations	
MSS405011A	Manage people relationships	
MSS405012A	Manage workplace learning	
MSS405020A	Develop quick changeover procedures	
MSS405021A	Develop a Just in Time system	
MSS405022A	Design a process layout	
MSS405023A	Develop a levelled pull system for operations and processes	
MSS405030A	Optimise cost of product or service	
MSS405031A	Undertake value analysis of a product or process costs in terms	



	of customer requirements	
MSS405032A	Analyse cost implications of maintenance strategy	
MSS405040A	Manage 5S system in an organisation	
MSS405050A	Determine and improve process capability	
MSS405052A	Design an experiment	
MSS405060A	Develop the application of enterprise control systems in an organisation	
MSS405061A	Determine and establish information collection requirements and processes	
MSS405070A	Develop and manage sustainable energy practices	
MSS405075A	Facilitate the development of a new product	
MSS405081A	Develop a proactive maintenance strategy	
MSS407001A	Prepare for and implement change	
MSS407002A	Review operations practice tools and techniques	
MSS407003A	Analyse process changes	
MSS407004A	Facilitate improvements in the internal value stream	
MSS407005A	Undertake a qualitative review of a process change	
MSS407006A	Build relationships between teams in an operations environment	
MSS407007A	Respond to a major non-conformance	
MSS407008A	Capture learning from daily activities in a organisation	
MSS407009A	Facilitate improvements in the external value stream	
MSS407010A	Improve visual management in the workplace	
MSS407011A	Manage benchmarking studies	
MSS407012A	Lead a problem solving process to determine and solve root cause	
MSS407013A	Review continuous improvement processes	
MSS408001A	Develop the competitive systems and practices approach	

MSS408002A	Audit the use of competitive tools	
MSS408003A	Develop models of future state operations practice	
MSS408004A	Develop the value stream	
MSS408005A	Develop the learning processes of the operations organisation	
MSS408006A	Develop and refine systems for continuous improvement in operations	
MSS408007A	Develop problem solving capability of a organisation	
MSS408008A	Analyse data for relevance to organisational learning	
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-pregs	4
PRSTS202A	Install security equipment/system	4
PRSTS302A	Program security equipment/system	2
PRSTS303A	Test installed security equipment/system	2
PRSTS304A	Commission/decommission security equipment/system	2
PRSTS305A	Identify and diagnose electronic security equipment/ system fault	2
PRSTS307A	Maintain and service security equipment/system	4
PRSTS317A	Provide estimate and quote	4
PRSTS319A	Modify and repair security equipment/system	4
SIRXSL201	Sell products and services	
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1

TLILIC2001A	Licence to operate a forklift truck	
TLILIC2002A	Licence to operate an order picking forklift truck	
TLILIC3003A	Licence to operate a bridge and gantry crane	
TLILIC3006A	Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)	
UEPMNT419B	Perform civil drafting	

# MEM10105 Certificate I in Engineering

## Modification History

Correction of training.gov.au transfer error - MSAENV272B added to elective selection.

Updated one unit of competency - MEM05006B to MEM05006C

## Description

The minimum requirements for achievement of the Certificate I in Engineering are:

- completion of all of the core units of competency listed below, and
- completion of elective units listed below to the value of at least 24 points.

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate elective units to the value of 5 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate I. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

## Pathways Information

Not Applicable

## Licensing/Regulatory Information

Not Applicable

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Read and interpret routine information on written job instructions and standard operating procedures. May include simple drawings</li> <li>• Follow verbal instructions</li> <li>• Enter routine and familiar information onto proforma and standard workplace forms</li> <li>• Orally report routine information</li> <li>• Use basic numeracy skills for undertaking comparison measurements</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Check material/product for conformance to specification</li> <li>• Identify waste and correct procedures for disposal</li> <li>• Identify routine problems/faults in machine/process/equipment operations and act/report as required</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge to specified situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards/problems during course of work</li> <li>• Minimise wasteful use of resources including materials and services in own work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Select, prepare and lay out or assemble materials and equipment correctly</li> <li>• Conduct pre-start checks on machinery/equipment</li> <li>• Plan steps required to complete routine task</li> <li>• Identify sequence of activities/operations</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Adhere to all safety requirements</li> <li>• Perform work in accordance with job instructions and work procedures</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Clarify tasks and required outcomes with appropriate personnel</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use dedicated tools, equipment and machines</li> </ul>

## Packaging Rules

### Core units

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15024A	Apply quality procedures
MEM16007A	Work with others in a manufacturing, engineering or related environment

### Elective units

- select units from this list to the value of at least 24 points, including any prerequisites.

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03006B	Set assembly stations	2
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04018B	Perform general woodworking machine operations	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2

Unit code	Unit title	P
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM06001B	Perform hand forging	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07003B	Perform machine setting (routine)	4
MEM07024B	Operate and monitor machine/process	4
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07032B	Use workshop machines for basic operations	2
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM11005B	Pick and process order	4

Unit code	Unit title	P
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11011B	Undertake manual handling	2
MEM11013B	Undertake warehouse receipt process	4
MEM11016B	Order materials	2
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM14005A	Plan a complete activity	4
MEM15001B	Perform basic statistical quality control	2
MEM15002A	Apply quality systems	2
MEM15003B	Use improvement processes in team activities	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16006A	Organise and communicate information	2
MEM16008A	Interact with computing technology	2



Unit code	Unit title	P
MEM17003A	Assist in the provision of on the job training	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18013B	Perform gland packing	2
MEM18038B	Maintain wheels and tyres	2
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19006B	Replace watch batteries	1
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25004B	Fair and shape surfaces	2
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4

Unit code	Unit title	P
MEM25014B	Perform marine slipping operations	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2
MSAENV272B	Participate in environmentally sustainable work practices	3

# MEM10205 Certificate I in Boating Services

## Modification History

The following units missing from the electives have been reinstated:

MEM50007B, 50008B, 50009B and 50010B, and MSAENV272B

## Description

The minimum requirements for achievement of the Certificate I in Boating Services are:

- completion of the seven core units of competency listed below, and completion of three elective units from the list below to bring the total number of units to 10.

Two elective units may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate I. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the suitability of any units proposed for importation from other Training Packages or accredited courses.

### *Additional qualification descriptors*

There are no approved additional descriptors for this qualification.

## Pathways Information

Not Applicable

## Licensing/Regulatory Information

Not Applicable

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Read, follow and communicate information on written job instructions, specifications, standard operating procedures, drawings and other applicable reference documents</li> <li>• Follow verbal instructions</li> <li>• Identify and follow safety signs/symbols</li> <li>• Recognise and use common boating terminology</li> <li>• Read and interpret information on boating identification and compliance plates, registration tags, engine and other component identification numbers</li> <li>• Use boating communication systems, methods and signals to convey messages</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Inspect quality of own work</li> <li>• Identify waste and correct procedures for disposal</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge to specified situations and contexts</li> <li>• Use appropriate responses in reaction to incidents and accidents.</li> <li>• Modify work plan to overcome unforeseen situations that occur as work progresses</li> <li>• Assist the business to maintain the quality of the environment</li> <li>• Minimise wasteful use of resources including materials and services in own work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Identify sequence of activities and plan steps required to complete task</li> <li>• Collect and organise information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or</li> </ul>

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
	service to ensure customer satisfaction • Take responsibility for own quality
Learning	• Check and clarify task related information with appropriate personnel • Review and modify work progress to complement the work of others
Technology	• Select and use appropriate tools, materials, equipment and machines • Identify and describe the functions of the major systems of a recreational vessel and trailer • Identify and describe features and functions of attached navigation and communication devices • Use navigation and communication systems and equipment

## Packaging Rules

### Core units

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15024A	Apply quality procedures
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM50001B	Classify recreational boating technologies and features
MEM50002B	Work safely on marine craft
MEM50003B	Follow work procedures to maintain the marine environment

### Elective units

- select three units from this list.

Unit code	Unit title
MEM09002B	Interpret technical drawing
MEM11010B	Operate mobile load shifting equipment
MEM11011B	Undertake manual handling
MEM12023A	Perform engineering measurements
MEM13003B	Work safely with industrial chemicals and materials
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM50004B	Maintain quality of environment by following marina codes
MEM50005B	Refuel vessels
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat
MEM50010B	Respond to boating emergencies and incidents
MSAENV272B	Participate in environmentally sustainable work practices

## MEM20105 Certificate II in Engineering

### Modification History

Release 4 - equivalent. ISC advice on target groups and pathways included.

### Description

This qualification covers the skills and knowledge required of workers employed as Engineering/manufacturing Employees -Level III as defined in the Manufacturing and Associated Industries and Occupations Award or in related industries where Engineering/Manufacturing Employees work.

The qualification has been specifically developed to reflect the minimum training requirement specified in the Award for employment in the above occupation. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off-the-job learning strategies such as those delivered through a formal traineeship. The qualification may also be achieved through formal skills recognition assessment processes.

### Application

This qualification is designed to provide an industry recognised skills profile related to production work as an Engineering/ Manufacturing Employee - Level III. Competency development would typically be undertaken through an Australian Apprenticeships arrangement where the integration of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and trainee.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and/or materials to cover the scope of application of those units. All outcomes must reflect the standard of performance required of the work associated with the Unit/s.

This qualification is not suited and should not be used for people who are not employed in an engineering production or manufacturing environment. It is not suited and should not be used for school students unless they are formally engaged in a traineeship in accordance with the Australian Apprenticeships policy.

### Pathways Information

Not Applicable

## Licensing/Regulatory Information

Not Applicable

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Read and interpret routine information on written job instructions and standard operating procedures. May include simple drawings</li> <li>• Follow verbal instructions</li> <li>• Enter routine and familiar information onto proforma and standard workplace forms</li> <li>• Orally report routine information</li> <li>• Use basic numeracy skills for undertaking comparison measurements</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Check material/product for conformance to specification</li> <li>• Identify waste and correct procedures for disposal</li> <li>• Identify routine problems/faults in machine/process/equipment operations and act/report as required</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge to specified situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards/problems during course of work</li> <li>• Minimise wasteful use of resources including materials and services in own work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Select, prepare and lay out or assemble materials and equipment correctly</li> <li>• Conduct pre-start checks on machinery/equipment</li> <li>• Plan steps required to complete routine task</li> <li>• Identify sequence of activities/operations</li> </ul>



**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Self-management	<ul style="list-style-type: none"><li>• Adhere to all safety requirements</li><li>• Perform work in accordance with job instructions and work procedures</li></ul>
Learning	<ul style="list-style-type: none"><li>• Clarify tasks and required outcomes with appropriate personnel</li></ul>
Technology	<ul style="list-style-type: none"><li>• Use dedicated tools, equipment and machines</li></ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate II in Engineering are:

- completion of all of the core units of competency listed below, and
- completion of elective units from the list below to the value of at least 30 points.

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1)

Appropriate elective units to the value of 6 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate II. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

### Core units

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task

Unit code	Unit title
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16007A	Work with others in a manufacturing, engineering or related environment

### Elective units

- select elective units from this list to the value of at least 30 points, including any prerequisites.

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04018B	Perform general woodworking machine	4

Unit code	Unit title	P
	operations	
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05027A	Perform aluminothermic welding	2
MEM05041B	Weld using powder flame spraying	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06005B	Perform drop and upset forging	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07003B	Perform machine setting (routine)	4

Unit code	Unit title	P
MEM07015B	Set computer controlled machines/processes	2
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste	3

Unit code	Unit title	P
	treatment process	
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10013A	Install split air conditioning systems and associated pipework	6
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4

Unit code	Unit title	P
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/movable load shifting equipment	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12019B	Measure components using coordinate measuring machine	4
MEM12023A	Perform engineering measurements	5
MEM12024A	Perform computations	3
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2

Unit code	Unit title	P
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM13013B	Work safely with ionizing radiation	4
MEM14005A	Plan a complete activity	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16006A	Organise and communicate information	2
MEM16008A	Interact with computing technology	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM17003A	Assist in the provision of on the job training	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18013B	Perform gland packing	2
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4

Unit code	Unit title	P
MEM18038B	Maintain wheels and tyres	2
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4



Unit code	Unit title	P
MEM19017B	Fabricate jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange	2
MEM21003A	Perform watch case servicing, repair and refurbishment	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches	2
MEM21006A	Service quartz watches	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25004B	Fair and shape surfaces	2
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25014B	Perform marine slipping operations	2

Unit code	Unit title	P
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4
MEM26009A	Select and use cores and fillers appropriate for product	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2
MSAENV272B	Participate in environmentally sustainable work practices	3
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2

# MEM20205 Certificate II in Engineering - Production Technology

## Modification History

Release 6 - equivalent. ISC advice on target groups and pathways included.

## Description

This qualification covers the skills and knowledge required of workers employed as Engineering/ Manufacturing Employees - Level IV as defined in the Manufacturing and Associated Industries and Occupations Award or in related industries where Engineering/ Manufacturing Employees work.

The qualification has been specifically developed to reflect the minimum training requirement specified in the Award for employment in the above occupation. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off-the-job learning strategies such as those delivered through a formal traineeship. The qualification may also be achieved through formal skills recognition assessment processes.

## Application

This qualification is designed to provide an industry recognised skills profile related to production work as an Engineering/ Manufacturing Employee - Level IV. Competency development would typically be undertaken through an Australian Apprenticeships arrangement where the integration of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and trainee.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and/or materials to cover the scope of application of those units. All outcomes must reflect the standard of performance required of the work associated with the Unit/s.

This qualification is not suited and should not be used for people who are not employed in an engineering production or manufacturing environment. It is not suited and should not be used for school students unless they are formally engaged in a traineeship in accordance with the Australian Apprenticeships policy.

## Pathways Information

Not Applicable

## Licensing/Regulatory Information

Not Applicable

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials</li><li>• Follow verbal instructions</li><li>• Enter routine and familiar information onto proforma and standard workplace forms</li><li>• Orally report routine information</li><li>• Recognise and use common workplace terminology</li><li>• Identify and follow safety signs and symbols</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Identify work roles, communicate and cooperate with others</li><li>• Consult with team leaders and appropriate personnel</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Check material/product for conformance to specification</li><li>• Identify problems/faults and act/report as required</li><li>• Undertake numerical operations including comparison measurements, geometry and calculations/formulae</li></ul>
Initiative and enterprise	<ul style="list-style-type: none"><li>• Be capable of applying the required skills and knowledge in a variety of situations and contexts</li><li>• Identify actual and foreseeable workplace hazards/problems during course of work</li><li>• Participate in quality systems and suggest improvements</li><li>• Prevent and minimise environmental risks and maximise opportunities for environmental improvement</li></ul>

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
Planning and organising	<ul style="list-style-type: none"> <li>• Select, prepare and lay out or assemble materials and equipment correctly</li> <li>• Conduct pre-start checks on machinery/equipment</li> <li>• Plan steps required to complete task</li> <li>• Identify activities and work outcomes</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Adhere to all relevant safety, quality and environmental requirements and guidelines</li> <li>• Perform work in accordance with job instructions, specifications and work procedures</li> <li>• Take responsibility for own quality</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Clarify tasks and required outcomes with appropriate personnel</li> <li>• Assist in the transfer of skills and knowledge to other employees</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment and machines</li> <li>• Apply knowledge of process, equipment and materials</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate II in Engineering - Production Technology are:

- completion of all of the core units of competency listed below, and
- completion of elective units from the list below to the value of at least 50 points.

Points associated with prerequisites count towards the total (refer to units for details).

Appropriate elective units to the value of 11 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate II. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

### *Additional qualification descriptors*

The following additional descriptors are approved for use with this qualification: Marine Craft Manufacturing; Surface Finishing; Marine Craft Surface Finishing

**Core units**

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

**Elective units**

- select elective units from this list to the value of at least 50 points, including any prerequisites.

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4

Unit code	Unit title	P
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05009C	Perform automated thermal cutting	2
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05023C	Weld using submerged arc welding process	4

Unit code	Unit title	P
MEM05027A	Perform aluminothermic welding	2
MEM05041B	Weld using powder flame spraying	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4



Unit code	Unit title	P
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM07041A	Perform production machining*	8
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6

Unit code	Unit title	P
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10009B	Install refrigeration and air conditioning plant and equipment	4
MEM10010B	Install pipework and pipework assemblies	4
MEM10011B	Terminate and connect specialist cables	3
MEM10013A	Install split air conditioning systems and associated pipework	6
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2

Unit code	Unit title	P
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/movable load shifting equipment	4
MEM11023A	Operate a bridge and gantry crane	4
MEM11024A	Undertake basic rigging*	4
MEM11025A	Operate a non-slewing mobile crane of greater than three tonnes capacity	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12019B	Measure components using coordinate measuring machine	4
MEM12020B	Set and operate coordinate measuring machine	2
MEM12024A	Perform computations	3
MEM13001B	Perform emergency first aid	1

Unit code	Unit title	P
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM13013B	Work safely with ionizing radiation	4
MEM14005A	Plan a complete activity	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16008A	Interact with computing technology	2
MEM16013A	Operate in a self-directed team	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18013B	Perform gland packing	2
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4

Unit code	Unit title	P
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18031B	Diagnose and rectify low voltage starting systems	2
MEM18032B	Maintain induction/exhaust systems	4
MEM18033B	Perform engine bottom-end overhaul	4
MEM18035B	Diagnose and rectify braking systems	6
MEM18037B	Diagnose and rectify low voltage charging systems	2
MEM18038B	Maintain wheels and tyres	2
MEM18039B	Diagnose and rectify track type undercarriage	4
MEM18040B	Maintain suspension systems	4
MEM18041B	Maintain steering systems	4
MEM18042C	Diagnose and rectify manual transmissions	4
MEM18043C	Diagnose and rectify automatic transmissions	8
MEM18044C	Diagnose and rectify drive line and final drives	4
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18063B	Terminate signal and data cables	4
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

Unit code	Unit title	P
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19008B	Prepare jewellery designs	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19013B	Produce jewellery metal masters	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19018B	Repair jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6

Unit code	Unit title	P
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM20006A	Maintain and service mechanical locking devices	6
MEM20014A	Perform a site security survey	2
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange	2
MEM21003A	Perform watch case servicing, repair and refurbishment	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches	2
MEM21006A	Service quartz watches	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4
MEM24001B	Perform basic penetrant testing	2
MEM24003B	Perform basic magnetic particle testing	2
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25004B	Fair and shape surfaces	2
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM26001A	Lay up composites using open moulding techniques	6

Unit code	Unit title	P
MEM26002A	Lay up composites using vacuum closed moulding techniques	6
MEM26003A	Lay up composites using pressure closed moulding techniques	6
MEM26004A	Make basic plugs for composites fabrication	3
MEM26005A	Make basic moulds for composites fabrication	3
MEM26006A	Mark and cut out sheets for composite use	4
MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4
MEM26009A	Select and use cores and fillers appropriate for product	2
MEM26010A	Store and handle composite materials	2
MEM26011A	Determine materials and techniques for a composite component or product*	6
MEM26012A	Record and trial work processes for one-off composite products	4
MEM26013A	Select and use composite processes or systems appropriate for product	4
MEM26014A	Adjust resin chemicals for current conditions	4
MEM26015A	Select and apply repair techniques	6
MEM26016A	Select and use joining techniques	6
MEM26017A	Prepare composite or other substrate surfaces	4
MEM26018A	Organise composite trials	4
MEM26019A	Finish a composite product	4
MEM26020A	Identify and interpret required standards for composites	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2



Unit code	Unit title	P
CPCCLDG3001A	Licence to perform dogging	0
CPCCLRG3001A	Licence to perform rigging basic level	0
CPCCLSF2001A	Licence to erect, alter and dismantle scaffolding basic level	0
CPCCLSF3001A	Licence to erect, alter and dismantle scaffolding intermediate level	0
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-preqs	4
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1
TLILIC2001A	Licence to operate a forklift truck	0
TLILIC2002A	Licence to operate an order picking forklift truck	0
TLILIC3003A	Licence to operate a bridge and gantry crane	0
TLILIC3006A	Licence to operate a non-slewing mobile crane (greater than three tonnes capacity)	0

## MEM20305 Certificate II in Boating Services

### Modification History

Release 3 - Title corrected for unit MEM05003B Perform soft soldering

### Description

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, follow and communicate information on written job instructions, specifications, standard operating procedures, drawings and other applicable reference documents</li><li>• Follow verbal instructions</li><li>• Identify and follow safety signs/symbols</li><li>• Recognise and use common boating terminology</li><li>• Read and interpret information on boating identification and compliance plates, registration tags, engine and other component identification numbers</li><li>• Use boating communication systems, methods and signals to convey messages</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Problem-solving	<ul style="list-style-type: none"> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Inspect quality of own work</li> <li>• Identify waste and correct procedures for disposal</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge to specified situations and contexts</li> <li>• Use appropriate responses in reaction to incidents and accidents.</li> <li>• Modify work plan to overcome unforeseen situations that occur as work progresses</li> <li>• Assist the business to maintain the quality of the environment</li> <li>• Minimise wasteful use of resources including materials and services in own work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Identify sequence of activities and plan steps required to complete task</li> <li>• Collect and organise information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for own quality</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel</li> <li>• Review and modify work progress to complement the work of others</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, materials, equipment and machines</li> <li>• Identify and describe the functions of the major systems of a recreational vessel and trailer</li> <li>• Identify and describe features and functions of attached navigation and communication devices</li> <li>• Use navigation and communication systems and equipment</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate II in Boating Services are:

- completion of the eight (8) core units of competency listed below, and
- completion of six (6) elective units from the list below to bring the total number of units to fourteen (14).

Note that when selecting elective units any prerequisite units must also be completed and count towards the required number of elective units (refer to units for details).

Two appropriate elective units may be chosen from other endorsed Training Packages and accredited courses where those units are available at Certificate II. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

### *Additional qualification descriptors*

There are no approved additional descriptors for this qualification.

### **Core units**

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM50001B	Classify recreational boating technologies and features
MEM50002B	Work safely on marine craft
MEM50003B	Follow work procedures to maintain the marine environment

**Elective units**

- select six units from this list.

Unit code	Unit title
MEM04018B	Perform general woodworking machine operations
MEM05003B	Perform soft soldering
MEM05005B	Carry out mechanical cutting
MEM05007C	Manual heating and thermal cutting
MEM05012C	Perform routine manual metal arc welding
MEM05050B	Perform routine gas metal arc welding
MEM09002B	Interpret technical drawing
MEM11010B	Operate mobile load shifting equipment
MEM11011B	Undertake manual handling
MEM12023A	Perform engineering measurements
MEM13003B	Work safely with industrial chemicals and materials
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM25001B	Apply fibre-reinforced materials
MEM25004B	Fair and shape surfaces
MEM25007B	Maintain marine vessel surfaces
MEM50004B	Maintain quality of environment by following marina codes
MEM50005B	Refuel vessels
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment

Unit code	Unit title
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat
MEM50010B	Respond to boating emergencies and incidents
MSAENV272B	Participate in environmentally sustainable work practices
TLILIC2001A	Licence to operate a forklift truck
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)

# MEM20413 Certificate II in Engineering Pathways

## Modification History

New qualification - Release 1

## Description

This qualification applies to a learning and assessment environment where access to structured on-the-job learning in a workplace may not be available. This qualification is only for delivery in learning institutions.

The qualification is intended for people interested in exposure to an engineering or related working environment with a view to entering into employment in that area. This qualification will equip graduates with knowledge and skills which will enhance their prospects of employment in an engineering or related working environment.

## Application

The learning program should develop trade-like skills but not attempt to develop trade-level skills. As an example, the outcome level of welding skills from this qualification is not about learning trade-level welding theory and practice; it is about being introduced to welding, how it can be used to join metal and having the opportunity to weld some metal together. Similarly with machining, the outcome should be something produced on a lathe etc., not the theory and practice of machining. The focus should be on using engineering tools and equipment to produce or modify objects. This needs to be done in a safe manner for each learner and those around them.

## Delivery

Registered Training Organisations (RTOs) offering this qualification will need to have access to basic engineering equipment and facilities, as well as sufficient open plan workshop facilities where long-term projects, perhaps spanning the duration of the learning, can be completed. The teachers/trainers must be experienced with the knowledge and trade skills to successfully facilitate and motivate skills development in the learners. Trainers and assessors must meet the NVR/AQTF trainer and assessor requirements for training and assessment, vocational competency and professional development.

The learning program should be centred around the major project.

*MSAPCI101A Adapt to work in industry* is a unit of competency that provides the opportunity for work placement.

## Pathways Information

### Pathways into the qualification

This qualification will be typically accessed by direct entry.

### Pathways from the qualification

This qualification delivers broad-based underpinning skills and knowledge in a range of engineering and manufacturing tasks which will enhance the graduates' entry-level employment prospects for apprenticeships, traineeships or general employment in an engineering-related workplace.

Achievement of competence in units *MEM13014A Apply principles of occupational health and safety in a work environment*, *MSAPMSUP106A Work in a team*, *MEM16006A Organise and communicate information*, *MEM16008A Interact with computing technology*, *MSAENV272B Participate in environmentally sustainable work practices*, *MEM18001C Use hand tools* and *MEM18002B Use power tools/hand held operations* will provide credit towards a range of manufacturing and engineering trade and production qualifications.

Achievement of competence in all of the other units will provide advanced progress towards reaching competence in units contained in other metal and engineering qualifications.

## Licensing/Regulatory Information

There are no specific licences that relate to this qualification.

## Entry Requirements

There are no entry requirements for this qualification.

## Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read and interpret routine information on written job instructions and standard operating procedures including simple drawings</li><li>• Follow verbal instructions</li><li>• Orally report routine information</li><li>• Use basic numeracy skills for undertaking measurements</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Identify work roles, communicate and cooperate with others</li></ul>



Problem-solving	<ul style="list-style-type: none"> <li>• Check material/product for conformance to specification</li> <li>• Identify waste and correct procedures for disposal</li> <li>• Identify routine problems/faults in machine/process/equipment operations and act/report as required</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge to specified situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards/problems during course of work</li> <li>• Minimise wasteful use of resources including materials and services in own work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Select, prepare and lay out or assemble materials and equipment correctly</li> <li>• Conduct pre-start checks on machinery/equipment</li> <li>• Plan steps required to complete routine task</li> <li>• Identify sequence of activities/operations</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Adhere to all safety requirements</li> <li>• Perform work in accordance with job instructions and work procedures</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Clarify tasks and required outcomes with appropriate personnel</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use dedicated tools, equipment and machines</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate II in Engineering Pathways are completion of a minimum of twelve (12) units of competency as described below:

- all of the core units of competency listed below
- a **minimum of seven (7)** Group A electives
- a **maximum of one (1)** Group B elective.

### Core units

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEMPE005A	Develop a career plan for the engineering and

Unit code	Unit title
	manufacturing industry
MEMPE006A	Undertake a basic engineering project
MSAENV272B	Participate in environmentally sustainable work practices

### Group A electives

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16008A	Interact with computing technology
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEMPE001A	Use engineering workshop machines
MEMPE002A	Use electric welding machines
MEMPE003A	Use oxy-acetylene and soldering equipment
MEMPE004A	Use fabrication equipment
MEMPE007A	Pull apart and re-assemble engineering mechanisms

### Group B Electives

Unit code	Unit title
MSAPCI101A	Adapt to work in industry
MSAPMSUP106A	Work in a team

## Custom Content Section

Not applicable.



## MEM30105 Certificate III in Engineering - Production Systems

### Modification History

Release 8 - Imported elective unit AURV225908A replaced by AURVTN2002. No change in outcomes.

Release 7 - equivalent. Inclusion of three new die correction electives.

### Description

This qualification covers the skills and knowledge required of workers employed as Engineering/Manufacturing Employees - Level V as defined in the Manufacturing and Associated Industries and Occupations Award or in related industries where Engineering/Manufacturing Employees work.

The qualification has been specifically developed to reflect the minimum training requirement specified in the Award for employment in the above occupation. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off-the-job learning strategies such as those delivered through a formal traineeship. The qualification may also be achieved through formal skills recognition assessment processes.

### *Application*

This qualification is designed to provide an industry recognised skills profile related to production work as an Engineering/ Manufacturing Employee - Level V. Competency development would typically be undertaken through an Australian Apprenticeships arrangement where the integration of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and trainee.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and/or materials to cover the scope of application of those units. All outcomes must reflect the standard of performance required of the work associates with the Unit/s.

This qualification is not suited and should not be used for people who are not employed in an engineering production or manufacturing environment. It is not suited and should not be used for school students unless they are formally engaged in a traineeship in accordance with the Australian Apprenticeships policy.

## Pathways Information

Not Applicable

## Licensing/Regulatory Information

Not Applicable

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or graphs</li><li>• Check and clarify task-related information</li><li>• Recognise and use common engineering terminology</li><li>• Liaise with appropriate authorities</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li><li>• Use appropriate measuring techniques</li><li>• Inspect quality of own or other employee's work</li><li>• Analyse information according to enterprise and work requirements</li><li>• Assess operation and condition of components against specifications or manufacturer's requirements</li><li>• Use diagnostic skills and tests to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li><li>• Translate designs into practical outcomes</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality, environmental compliance and improvement, and internal/external customer/supplier relationships</li> <li>• Economise material use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations/complete activities/ scheduled production</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li> <li>• Produce sketches, diagrams, charts or graphs</li> <li>• Check and clarify task-related information</li> <li>• Recognise and use common engineering terminology</li> <li>• Liaise with appropriate authorities</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate III in Engineering - Production Systems are:

- completion of all core units of competency listed below, and
- completion of Group A production stream units from the list below to the value of at least 40 points, and
- completion of Group B specialisation units from the list below to bring the total value of elective units to at least 73 points.

Points associated with prerequisites count towards the total (refer to units for details).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

### *Additional qualification descriptors*

The following additional descriptors are approved for use with this qualification: Surface Finishing; Marine Craft Surface Finishing.

### **Core Units**

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems

Unit code	Unit title
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

## Elective Units

### Group A - Production stream units

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04006B	Operate sand moulding and core making machines	8



Unit code	Unit title	P
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05027A	Perform aluminothermic welding	2
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06006C	Repair springs	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07042A	Undertake corrections and basic maintenance to aluminium extrusion dies and die support systems	4
MEM07043A	Identify causes of faulty aluminium extrusions	6
MEM07044A	Test a new aluminium extrusion die	4
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition	4

Unit code	Unit title	P
	methods	
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4

Unit code	Unit title	P
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/movable load shifting equipment	4
MEM11023A	Operate a bridge and gantry crane	4
MEM11024A	Undertake basic rigging*	4
MEM11025A	Operate a non-slewing mobile crane of greater than three tonnes capacity	4

Unit code	Unit title	P
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12019B	Measure components using coordinate measuring machine	4
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2
MEM26001A	Lay up composites using open moulding techniques	6
MEM26002A	Lay up composites using vacuum closed moulding techniques	6
MEM26003A	Lay up composites using pressure closed moulding techniques	6
MEM26004A	Make basic plugs for composites fabrication	3
MEM26005A	Make basic moulds for composites fabrication	3
MEM26006A	Mark and cut out sheets for composite use	4
MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4

Unit code	Unit title	P
MEM26009A	Select and use cores and fillers appropriate for product	2
MEM26010A	Store and handle composite materials	2
MEM26011A	Determine materials and techniques for a composite component or product*	6
MEM26012A	Record and trial work processes for one-off composite products	4
MEM26013A	Select and use composite processes or systems appropriate for product	4
MEM26014A	Adjust resin chemicals for current conditions	4
MEM26015A	Select and apply repair techniques	6
MEM26016A	Select and use joining techniques	6
MEM26017A	Prepare composite or other substrate surfaces	4
MEM26018A	Organise composite trials	4
MEM26019A	Finish a composite product	4
MEM26020A	Identify and interpret required standards for composites	2
CPCCLDG3001A	Licence to perform dogging	0
CPCCLRG3001A	Licence to perform rigging basic level	0
CPCCLSF2001A	Licence to erect, alter and dismantle scaffolding basic level	0
CPCCLSF3001A	Licence to erect, alter and dismantle scaffolding intermediate level	0
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1
TLILIC2001A	Licence to operate a forklift truck	0
TLILIC2002A	Licence to operate an order picking forklift truck	0
TLILIC3003A	Licence to operate a bridge and gantry crane	0

Unit code	Unit title	P
TLILIC3006A	Licence to operate a non-slewing mobile crane (greater than three tonnes capacity)	0

### Group B - Specialisation units

- select units from this list to bring the total value of Production stream and Specialisation units to at least 73 points, including any prerequisites.

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2

Unit code	Unit title	P
MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05009C	Perform automated thermal cutting	2
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05023C	Weld using submerged arc welding process	4
MEM05041B	Weld using powder flame spraying	4
MEM05047B	Weld using flux core arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2

Unit code	Unit title	P
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM05054A	Write basic NC/CNC programs for thermal cutting machines	4
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07002B	Perform precision shaping/planing/slotting operations	4
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07010B	Perform tool and cutter grinding operations	4
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2



Unit code	Unit title	P
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07022C	Program CNC wire cut machines	2
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM07041A	Perform production machining*	8
MEM07042A	Undertake corrections and basic maintenance to aluminium extrusion dies and die support systems	4
MEM07043A	Identify causes of faulty aluminium extrusions	6
MEM07044A	Test a new aluminium extrusion die	4
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6

Unit code	Unit title	P
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM09011B	Apply basic engineering design concepts	6
MEM09022A	Create 2D code files using computer aided manufacturing system	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10004B	Enter and change programmable controller operational parameters	2

Unit code	Unit title	P
MEM10011B	Terminate and connect specialist cables	3
MEM10013A	Install split air conditioning systems and associated pipework	6
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2

Unit code	Unit title	P
MEM11022B	Operate fixed/moveable load shifting equipment	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM11023A	Operate a bridge and gantry crane	4
MEM11024A	Undertake basic rigging*	4
MEM11025A	Operate a non-slewing mobile crane of greater than three tonnes capacity	4
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12019B	Measure components using coordinate measuring machine	4
MEM12020B	Set and operate coordinate measuring machine	2
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise	4
MEM13010A	Supervise occupational health and safety in an industrial work environment	4
MEM13013B	Work safely with ionizing radiation	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2

Unit code	Unit title	P
MEM15005B	Select and control inspection processes and procedures	4
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16011A	Communicate with individuals and small groups	2
MEM16013A	Operate in a self-directed team	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18063B	Terminate signal and data cables	4
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

Unit code	Unit title	P
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM20006A	Maintain and service mechanical locking devices	6

Unit code	Unit title	P
MEM20014A	Perform a site security survey	2
MEM24001B	Perform basic penetrant testing	2
MEM24002B	Perform penetrant testing	4
MEM24003B	Perform basic magnetic particle testing	2
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4
MEM25004B	Fair and shape surfaces	2
MEM25005B	Construct and assemble marine vessel timber components	8
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25008B	Repair marine vessel surfaces and structures	4
MEM25009B	Form timber shapes using hot processes	2
MEM25010B	Perform fitout procedures	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25013B	Produce three-dimensional plugs/moulds	12
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	4
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1

Unit code	Unit title	P
MEM50009B	Safely operate a mechanically powered recreational boat	2
MSAENV472B	Participate in environmentally sustainable work practices	4
AURVTN2002	Carry out panel repairs	4
CPCCLDG3001 A	Licence to perform dogging	0
CPCCLRG3001 A	Licence to perform rigging basic level	0
CPCCLSF2001 A	Licence to erect, alter and dismantle scaffolding basic level	0
CPCCLSF3001 A	Licence to erect, alter and dismantle scaffolding intermediate level	0
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1
TLILIC2001A	Licence to operate a forklift truck	0
TLILIC2002A	Licence to operate an order picking forklift truck	0
TLILIC3003A	Licence to operate a bridge and gantry crane	0
TLILIC3006A	Licence to operate a non-slewing mobile crane (greater than three tonnes capacity)	0
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-pregs	4



# MEM30205 Certificate III in Engineering - Mechanical Trade

## Modification History

ISC upgrade to include new units in Trade Specialisation list. Refer to Mapping of Changes.

## Description

This qualification covers the skills and knowledge required to work as an Engineering Tradesperson - Mechanical within metal, engineering, manufacturing and associated industries or other industries where Engineering Tradesperson - Mechanical work. The qualification has been specifically developed for apprentices in the above trade. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

### *Job roles/employment outcome*

The Certificate III in Engineering - Mechanical Trade specifies the competencies required for employment as an Engineering Tradesperson - Mechanical including the design, assembly, manufacture, installation, modification, testing, fault finding, commissioning, maintenance and service of all mechanical equipment, machinery, fluid power systems, stationary and mobile equipment, instruments, refrigeration, and the use of computer controlled machine tools.

Employment outcomes related to this qualification are found in a wide variety of manufacturing and engineering related sectors as well as Engineering Tradesperson - Mechanical roles in other industries.

### *Application*

This qualification is designed to provide an industry recognised skills profile related to trade work as an Engineering Tradesperson - Mechanical. Skills development would be undertaken through an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

Occupational titles that this qualification is suitable for may vary and include mechanical tradesperson, fitter and turner, fitter and machinist, maintenance fitter, diesel fitter, plant mechanic, refrigeration mechanic and 1st class machinist.

## Pathways Information

### *Pathways into the qualification*

There is no qualification entry requirement. It is assumed that the learner is engaged as an apprentice under a Training Contract and that the learner is receiving appropriate structured on-the-job training while undertaking this qualification.

This qualification may be accessed by direct entry. Credit may be granted towards this qualification by those who have completed MEM10105 Certificate I in Engineering, MEM10205 Certificate I in Boating Services, MEM20105 Certificate II in Engineering, MEM20205 Certificate II in Engineering - Production Technology or other relevant qualifications. Credit towards this qualification may also include units of competency contained within relevant skill sets and Statements of Attainment.

### *Pathways from the qualification*

Further training pathways from this qualification include MEM40105 Certificate IV in Engineering and MEM50105 Diploma of Engineering - Advanced Trade or other relevant qualifications.

### *Additional qualification advice*

An additional descriptor may be added to this qualification to illustrate a particular skills focus or trade discipline.

This could be achieved by adding a pathway descriptor or sentence *below* the formal title of the qualification. Note that no changes may be made to the qualification title and the use of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

There are no specific requirements associated with the use of these descriptors other than their use should reflect the nature of the choice of units of competency in the qualification and must be consistent with the work role of an Engineering Tradesperson - Mechanical.

Reference to other occupational or functional pathways consistent with the role of an Engineering Tradesperson - Mechanical may be included on any qualification statement that is issued.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

### *Licensing considerations*

There are no specific licences that relate to this qualification. However, some units in this qualification may relate to licensing or regulatory requirements. Where appropriate electives are taken these can also be used to satisfy regulations regarding refrigeration and air conditioning work. Local regulations should be checked for details.

## Licensing/Regulatory Information

Refer to Pathways Information

## Entry Requirements

Not Applicable

## Employability Skills Summary

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
<b>Employability Skill</b>	<b>Industry/enterprise requirements for this qualification include:</b>
Communication	<ul style="list-style-type: none"> <li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li> <li>• Produce sketches, diagrams, charts or graphs</li> <li>• Check and clarify task-related information</li> <li>• Recognise and use common mechanical engineering terminology and symbols</li> <li>• Liaise with appropriate authorities</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Analyse information according to enterprise and work requirements</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Use diagnostic skills and tests to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li> <li>• Develop, implement and evaluate solutions to problems</li> <li>• Translate designs into practical outcomes</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> <li>• Economise material and energy use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations/ complete activities/ scheduled production</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> <li>• Assist with on the job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of appropriate engineering principles,</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>techniques, procedures, diagnostic methods, tools and equipment to achieve the required outcome</p> <ul style="list-style-type: none"> <li>• Calibrate equipment/instruments</li> <li>• Improve efficiency of machines and equipment in order to minimise waste</li> </ul>
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## Packaging Rules

### Packaging Rules

The minimum requirements for achievement of the Certificate III in Engineering - Mechanical Trade are:

- completion of all core units of competency listed below, and
- completion of Group A Mechanical Trade stream units to the value of at least 40 points, and
- completion of units from Group B Certificate III Trade specialisation units listed in Appendix 1, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Mechanical Trade occupational outcomes.

### *Additional qualification descriptors*

The following additional descriptors are approved for use with this qualification:  
Refrigeration and Air Conditioning; Instrumentation; Maintenance; Patternmaking;  
Toolmaking; Watchmaking; Machining.

**Core units**

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

**Elective Units****Group A - Mechanical Trade stream units**

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
MEM07001B	Perform operational maintenance of machines/equipment	2

Unit code	Unit title	P
MEM07002B	Perform precision shaping/planing/slotting operations	4
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM07009B	Perform precision jig boring operations	4
MEM07010B	Perform tool and cutter grinding operations	4
MEM07011B	Perform complex milling operations	4
MEM07012B	Perform complex grinding operations	4
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2

Unit code	Unit title	P
MEM07021B	Perform complex lathe operations	4
MEM07022C	Program CNC wire cut machines	2
MEM07023C	Program and set up CNC manufacturing cell	6
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM09002B	Interpret technical drawing	4
MEM09022A	Create 2D code files using computer aided manufacturing system	4
MEM10004B	Enter and change programmable controller operational parameters	2



Unit code	Unit title	P
MEM10006B	Install machine/plant	4
MEM12003B	Perform precision mechanical measurement	2
MEM12006C	Mark off/out (general engineering)	4
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18004B	Maintain and overhaul mechanical equipment	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
MEM18008B	Balance equipment	2
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18011C	Shut down and isolate machines/equipment	2
MEM18012B	Perform installation and removal of mechanical seals	2
MEM18013B	Perform gland packing	2

Unit code	Unit title	P
MEM18014B	Manufacture press tools and gauges	8
MEM18015B	Maintain tools and dies	4
MEM18018C	Maintain pneumatic system components	4
MEM18019B	Maintain pneumatic systems	4
MEM18020B	Maintain hydraulic system components	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18031B	Diagnose and rectify low voltage starting systems	2
MEM18032B	Maintain induction/exhaust systems	4
MEM18033B	Perform engine bottom-end overhaul	4
MEM18034B	Perform engine top-end overhaul	8
MEM18035B	Diagnose and rectify braking systems	6
MEM18037B	Diagnose and rectify low voltage	2

Unit code	Unit title	P
	charging systems	
MEM18038B	Maintain wheels and tyres	2
MEM18039B	Diagnose and rectify track type undercarriage	4
MEM18040B	Maintain suspension systems	4
MEM18041B	Maintain steering systems	4
MEM18042C	Diagnose and rectify manual transmissions	4
MEM18043C	Diagnose and rectify automatic transmissions	8
MEM18044C	Diagnose and rectify drive line and final drives	4
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
MEM18052B	Maintain fluid power systems for mobile plant	4

Unit code	Unit title	P
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18058C	Modify electronic equipment	4
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18063B	Terminate signal and data cables	4
MEM18064B	Maintain instrumentation system components	6
MEM18065B	Diagnose and repair digital equipment and components	10
MEM18066B	Diagnose and repair microprocessor-based equipment	6
MEM18067B	Tune control loops - multi controller or multi element systems	6
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4

Unit code	Unit title	P
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6
MEM18088B	Maintain and repair commercial air conditioning systems and components	4
MEM18089B	Maintain and repair central air handling systems	6
MEM18090B	Maintain and repair industrial refrigeration systems and components	6
MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	4
MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6
MEM18094B	Service and repair commercial refrigeration	6
MEM18095A	Maintain and repair cooling towers/evaporative condensers and associated equipment	4
MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	6
MEM18097A	Manufacture cavity dies	8
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2

### Group B - Trade Specialisation units

- Select units from the Certificate III Trade Specialisation units listed in Appendix 1, Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites.
-

# MEM30305 Certificate III in Engineering - Fabrication Trade

## Modification History

ISC upgrade to include new units in Trade Specialisation list. Refer to Mapping of Changes.

## Description

This qualification covers the skills and knowledge required for employment as an Engineering Tradesperson - Fabrication within the metal, engineering, manufacturing and associated industries or other industries where Engineering Tradespersons - Fabrication work. The qualification has been specifically developed to meet the needs of apprentices in the above trade. The qualification packaging has been developed on an assumption that competency will be developed through an integrated combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

### *Job roles/employment outcomes*

The Certificate III in Engineering - Fabrication Trade specifies the competencies required for employment as an Engineering Tradesperson - Fabrication including metal fabrication, forging, founding, structural steel erection, electroplating, metal spinning, metal polishing, sheet metal work, welding and the use of related computer controlled equipment.

Employment outcomes related to this qualification are found in a wide variety of manufacturing and engineering related sectors as well as Engineering Tradesperson - Fabrication roles in other industries.

### *Application*

This qualification is designed to provide an industry recognised skills profile related to trade work as an Engineering Tradesperson - Fabrication. Skills development would usually be undertaken through an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

Occupational titles that this qualification is suitable for may vary and include metal fabrication tradesperson, boilermaker, 1<sup>st</sup> class sheet metal worker, 1<sup>st</sup> class welder, moulder, foundry tradesperson and patternmaker.

## Pathways Information

### *Pathways into the qualification*

There is no qualification entry requirement. It is assumed that the learner is engaged as an apprentice under a Training Contract and that the learner is receiving appropriate structured on the job training while undertaking this qualification.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed MEM10105 Certificate I in Engineering, MEM10205 Certificate I in Boating Services, MEM20105 Certificate II in Engineering, MEM20205 Certificate II in Engineering - Production Technology or other relevant qualifications. Credit towards this qualification may also include units of competency contained within relevant pre-vocational and pre-apprenticeship programs and Statements of Attainment.

### *Pathways from the qualification*

Further training pathways from this qualification include MEM40105 Certificate IV in Engineering and MEM50105 Diploma of Engineering - Advanced Trade or other relevant qualifications.

### *Additional qualification advice*

An additional descriptor may be added to this qualification to illustrate a particular skill focus or trade discipline.

This could be achieved by adding a pathway descriptor or sentence *below* the formal title of the qualification. Note that no changes may be made to the qualification title and the use of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

There are no specific requirements associated with the use of these descriptors other than their use should reflect the nature of the choice of units of competency in the qualification and must be consistent with the work role of an Engineering Tradesperson - Fabrication.

Reference to other occupational or functional pathways consistent with the role of an Engineering Tradesperson - Fabrication may be included on any qualification statement that is issued.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

### *Licensing considerations*

There are no specific licences that relate to this qualification. However, some units of competency in this qualification may relate to licensing or regulatory requirements. Local regulations should be checked for details.

## Licensing/Regulatory Information

Refer to Pathways Information

## Entry Requirements

Not Applicable

## Employability Skills Summary

### EMPLOYABILITY SKILLS QUALIFICATION SUMMARY

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li> <li>• Convey and share technical information</li> <li>• Produce sketches, diagrams, charts or graphs</li> <li>• Check and clarify task-related information</li> <li>• Recognise and use common fabrication terminology</li> <li>• Liaise with appropriate authorities</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Analyse information according to enterprise and work requirements</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li> <li>• Translate designs into practical outcomes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course</li> </ul>



**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>of work</p> <ul style="list-style-type: none"> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> <li>• Economise material use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations/complete activities/scheduled production</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental guidelines and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> <li>• Assist with on the job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of appropriate engineering principles, techniques, procedures, tools and equipment to achieve the required outcome</li> </ul>

## Packaging Rules

### Packaging Rules

The minimum requirements for achievement of the Certificate III in Engineering - Fabrication Trade are:

- completion of all core units of competency listed below, and
- completion of Group A Fabrication stream units listed below to the value of at least 40 points, and
- completion of units from Group B Certificate III Trade specialisation units listed in Appendix 1, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Fabrication Trade occupational outcomes.

### *Additional qualification descriptors*

The following additional descriptors are approved for use with this qualification: Casting and Moulding; Heavy Fabrication; Light Fabrication; Maintenance; Patternmaking; Surface Finishing; Welding.

### Core units

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements

Unit code	Unit title
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

### Elective Units

#### Group A - Fabrication Trade stream units

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
MEM03003B	Perform sheet and plate assembly	4
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4

Unit code	Unit title	P
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2
MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04016C	Develop and manufacture precision models	6
MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	4
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering	4

Unit code	Unit title	P
	and desoldering	
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	2
MEM05009C	Perform automated thermal cutting	2
MEM05010C	Apply fabrication, forming and shaping techniques	8
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4
MEM05018C	Perform advanced welding using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4

Unit code	Unit title	P
MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
MEM05022C	Perform advanced welding using oxy acetylene welding process	6
MEM05023C	Weld using submerged arc welding process	4
MEM05026C	Apply welding principles	4
MEM05036C	Repair/replace/modify fabrications	4
MEM05037C	Perform geometric development	6
MEM05038B	Perform advanced geometric development - cylindrical/rectangular	2
MEM05039B	Perform advanced geometric development - conical	2
MEM05040B	Perform advanced geometric development - transitions	4
MEM05041B	Weld using powder flame spraying	4
MEM05047B	Weld using flux core arc welding process	4
MEM05048B	Perform advanced welding using flux core arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM05054A	Write basic NC/CNC programs for	4

Unit code	Unit title	P
	thermal cutting machines	
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents	2

Unit code	Unit title	P
	and/or mechanical means	
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM10001C	Erect structures	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2

### Group B - Trade Specialisation units

Select units from the Certificate III Trade Specialisation units listed in Appendix 1, Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites.



# MEM30405 Certificate III in Engineering - Electrical/Electronic Trade

## Modification History

Updated one unit of competency - MEM05006B to MEM05006C

## Description

This qualification covers the skills and knowledge required for employment as an Engineering Tradesperson - Electrical/Electronic within the metal, engineering, manufacturing and associated industries or other industries where Engineering Tradespersons - Electrical/Electronic work. The qualification has been specifically developed for apprentices in the above trade. The qualification packaging has been developed on an assumption that competency will be developed through an integrated combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

### *Job roles/employment outcomes*

The Certificate III in Engineering - Electrical/Electronic Trade specifies the competencies required for employment as an Engineering Tradesperson - Electrical/Electronic including the design, assembly, manufacture, installation, modification, testing, fault finding, commissioning, maintenance and service of all electrical and electronic devices systems, equipment and controls e.g. electrical wiring, motors, generators, PLCs, and other electronic controls, instruments, refrigeration, telecommunications, radio and television, communication and information processing.

Employment outcomes related to this qualification are found in a wide variety of manufacturing and engineering related sectors as well as Engineering Tradesperson - Electrical/Electronic trade related roles in other industries.

### *Application*

This qualification is designed to provide an industry recognised skills profile related to trade work as an Engineering Tradesperson - Electrical/Electronic. Skills development would usually be undertaken through an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

Occupational titles at the enterprise level covered by this qualification may vary and include engineering tradesperson - electrical/electronic, electrical fitter, electrical mechanic, electrical fitter/mechanic, electrician, refrigeration mechanic and radio tradesperson.

## Pathways Information

### *Pathways into the qualification*

While there is no qualification entry requirement, it is assumed that the learner is engaged as an apprentice under a Training Contract and that the learner is receiving appropriate structured on-the-job training while undertaking this qualification.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed MEM10105 Certificate I in Engineering, MEM10205 Certificate I in Boating Services, MEM20105 Certificate II in Engineering, MEM20205 Certificate II in Engineering - Production Technology or other relevant qualifications. Credit towards this qualification may also include units of competency contained within relevant pre-vocational and pre-apprenticeship programs and Statements of Attainment.

### *Pathways from the qualification*

Further training pathways from this qualification include MEM40105 Certificate IV in Engineering, MSA41108 Certificate IV in Competitive Manufacturing, MSA40108 Certificate IV in Manufacturing Technology or other relevant qualifications.

### *Additional qualification advice*

An additional descriptor may be added to this qualification title to illustrate a particular skills profile.

This could be achieved by adding a pathway descriptor or sentence *below* the formal title of the qualification. Note that no changes may be made to the qualification title and the use of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

There are no specific requirements associated with the use of these descriptors other than their use should reflect the nature of the choice of units of competency in the qualification and must be consistent with the work role of an Engineering Tradesperson - Electrical/Electronic.

Reference to other occupational or functional pathways consistent with the role of an Engineering Tradesperson - Electrical/Electronic may be included on any qualification statement that is issued.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

### *Licensing considerations*

If appropriate electives are undertaken this qualification can be used as the basis for an application in each state and territory for a license to practise as an electrician. It can also be used to satisfy regulations regarding refrigeration and airconditioning work. Local regulations should be checked for details.

## Licensing/Regulatory Information

Refer to Pathways Information

## Entry Requirements

Not Applicable

## Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret and follow information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Interpret, record and communicate information including measurements</li><li>• Produce sketches, diagrams, charts or graphs</li><li>• Check and clarify task-related information</li><li>• Recognise and use common workplace terminology</li><li>• Tag, mark or label cabling for identification</li><li>• Interpret circuit diagrams</li><li>• Provide advice on minimising electricity use</li><li>• Liaise with appropriate authorities</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Undertake numerical operations, geometry and calculations/formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li><li>• Use appropriate measuring techniques</li><li>• Inspect quality of own or other employee's work</li><li>• Analyse information according to enterprise and work</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>requirements</p> <ul style="list-style-type: none"> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Use diagnostic skills and tests to identify and determine causes of electrical faults, including interpretation of in-built fault indicators and error codes</li> <li>• Translate designs into practical outcomes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations/complete activities/scheduled production</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice, environmental guidelines and product/process developments</li> <li>• Assist with on the job training and assessment</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Technology	<ul style="list-style-type: none"><li>• Select and use appropriate tools, equipment, materials and machines</li><li>• Select and use appropriate measuring/testing devices</li><li>• Perform calculations using a calculator</li><li>• Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li><li>• Apply knowledge of appropriate engineering principles, techniques, procedures, tools and equipment to achieve the required outcome</li><li>• Apply techniques, tools and equipment required to install/maintain electrical equipment/systems/components</li><li>• Use tools, equipment and techniques to test the operation of electrical equipment/components/systems</li><li>• Calibrate instrumentation equipment/components</li></ul>
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## Packaging Rules

### Packaging Rules

The minimum requirements for achievement of the Certificate III in Engineering - Electrical/Electronic Trade are:

- completion of all core units of competency listed below, and
- completion of units from the Group A Electrical/Electronic Stream to the value of at least 40 points, and
- completion of units from Group B Certificate III Trade specialisation units listed in Appendix 1, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Electrical/Electronic Trade occupational outcomes

### ***Additional qualification descriptors***

The following additional descriptors are approved for use with this qualification:  
Refrigeration and Air-conditioning; Instrumentation; Maintenance; Marine Electronics.

### **Core Units**

- select all of the units from this list

<b>Unit code</b>	<b>Unit title</b>
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

### **Electives**

#### **Group A - Electrical/Electronic Trade stream units**

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM12002B	Perform electrical/electronic measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18048B	Fault find and repair/rectify basic electrical circuits	12

Unit code	Unit title	P
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
MEM18052B	Maintain fluid power systems for mobile plant	4
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18058C	Modify electronic equipment	4
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18063B	Terminate signal and data cables	4
MEM18064B	Maintain instrumentation system components	6
MEM18065B	Diagnose and repair digital equipment and components	10
MEM18098A	Prepare to perform work associated with fuel system installation and	2



Unit code	Unit title	P
	servicing*	

### Group B - Trade Specialisation units

Select units from the Certificate III Trade Specialisation units listed in Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites

**Note:** The following units of competency are required to meet the National Uniform Electrical Licensing '66 essential capabilities' for an electrician's license.

Unit code	Unit title	P
MEM12023A	Perform engineering measurements	n/a
MEM12024A	Perform computations	n/a
MEM13014A	Apply principles of occupational health and safety in the work environment	n/a
MEM14004A	Plan to undertake a routine task	n/a
MEM14005A	Plan a complete activity	n/a
MEM15002A	Apply quality systems	n/a
MEM15024A	Apply quality procedures	n/a
MEM16006A	Organise and communicate information	n/a
MEM16007A	Work with others in a manufacturing, engineering or related environment	n/a
MEM16008A	Interact with computing technology	n/a
MEM17003A	Assist in the provision of on the job training	n/a
MEM09002B	Interpret technical drawing	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500	12

Unit code	Unit title	P
	volts d.c.	
MEM10004B	Enter and change programmable controller operational parameters	2
MEM10011B	Terminate and connect specialist cables	3
MEM12002B	Perform electrical/electronic measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
	Points total	65

## MEM30505 Certificate III in Engineering - Technical

### Modification History

Release 2 - Addition of new and updated elective units covering skills in computer-aided design/drafting (CAD) operations. Outcomes are equivalent.

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce detail drawings using standard engineering drawing symbols, references and terminology</li><li>• Prepare drafts of functional and operational requirements</li><li>• Liaise with internal and external stakeholders</li><li>• Use communication and negotiation skills</li><li>• Write reports</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Verify operational requirements with supervisor or team</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Analyse information according to enterprise and work requirements</li><li>• Apply mathematical techniques to solve problems</li><li>• Analyse manufacturing/ production system components</li></ul>

	<ul style="list-style-type: none"> <li>• Apply engineering principles to translate designs into practical outcomes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Implement OHS risk management procedures</li> <li>• Economise material use and minimise waste and energy use</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including procedures to improve processes, quality, environmental performance, and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Organise, categorise and sequence information</li> <li>• Plan and sequence work operations/complete activities/scheduled production</li> <li>• Source and organise required information from workshop manuals, customer specifications, product suppliers, designers or similar</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Take responsibility for work outcomes</li> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Use manuals, online help and other reference materials as required</li> <li>• Check and clarify task-related information</li> <li>• Assess and modify own work practices</li> <li>• Research equipment function and operational requirements</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Know functions and capabilities of various types of computing technology and software used in the workplace</li> <li>• Use a CAD program, computer and peripherals</li> <li>• Apply knowledge of basic mechanical components, drive components, pneumatic systems, hydraulic systems</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate III in Engineering - Technical are:

- completion of the three (3) core units of competency listed below, and
- completion of seven (7) elective units of competency from the list below to bring the total of units selected to ten (10).

Note that when selecting elective units any prerequisite units must also be completed and can be counted towards the required number of elective units (refer to units and prerequisites listing in Appendix 2).

Note also that additional requirements apply to the selection of non-destructive testing units. These additional requirements are listed at the end of the elective units.

Up to two (2) appropriate electives may be chosen from other endorsed Training Packages and accredited courses where those units are available in a Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

### ***Additional qualification descriptors***

There are no approved additional descriptors for this qualification.

### **Core units**

- Select all of the units from this list.

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16008A	Interact with computing technology
MSAENV272B	Participate in environmentally sustainable work practices

**Note:** It is anticipated that many learners will have gained these skills through Year 12 school study and be eligible for recognition of prior learning. The actual awarding of the units will be subject to assessment by the Registered Training Provider offering the qualification.

### **Elective units**

- Select seven (7) units from this list.

Unit code	Unit title	Prerequisites
MEM05051A	Select welding processes	
MEM09002B	Interpret a technical drawing	

MEM09201A	Work effectively in an engineering drafting workplace	
MEM09202A	Produce freehand sketches	
MEM09203A	Measure and sketch site information	
MEM09205A	Produce electrical schematic drawings	*
MEM09208A	Detail fasteners and locking devices in mechanical drawings	*
MEM09209A	Detail bearings, seals and other componentry in mechanical drawings	*
MEM09213A	Produce schematic drawings for hydraulic and pneumatic fluid power systems	*
MEM12023A	Perform engineering measurements	
MEM12024A	Perform computations	
MEM13013B	Work safely with ionizing radiation	
MEM15001B	Perform basic statistical quality control	
MEM16003B	Provide advanced customer service	
MEM18001C	Use hand tools	
MEM24001B	Perform basic penetrant testing	*
MEM24003B	Perform basic magnetic particle testing	*
MEM24005B	Perform basic eddy current testing	*
MEM24007B	Perform ultrasonic thickness testing	*
MEM24009B	Perform basic radiographic testing	*
MEM30005A	Calculate force systems within simple beam structures	*
MEM30006A	Calculate stresses in simple structures	*
MEM30007A	Select common engineering materials	
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications	

MEM30009A	Contribute to the design of basic mechanical systems	*
MEM30010A	Set up basic hydraulic circuits	
MEM30011A	Set up basic pneumatic circuits	
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	
MEM30013A	Assist in the preparation of a basic workplace layout	
MEM30014A	Apply basic just in time systems to the reduction of waste	
MEM30015A	Develop recommendations for basic set up time improvements	
MEM30016A	Assist in the analysis of a supply chain	
MEM30017A	Use basic preventative maintenance techniques and tools	
MEM30018A	Undertake basic process planning	
MEM30019A	Use resource planning software systems in manufacturing	*
MEM30020A	Develop and manage a plan for a simple manufacturing related project	
MEM30021A	Prepare a simple production schedule	
MEM30022A	Undertake supervised procurement activities	
MEM30023A	Prepare a simple cost estimate for a manufactured product	
MEM30024A	Participate in quality assurance techniques	*
MEM30025A	Analyse a simple electrical system circuit	*
MEM30026A	Select and test components for simple electronic switching and timing circuits	*
MEM30027A	Prepare basic programs for programmable logic controllers	

MEM30028A	Assist in sales of technical products/systems	
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM30032A	Produce basic engineering drawings	
MEM30033A	Use computer-aided design (CAD) to create and display 3-D models	*
MSATCS301A	Interpret architectural and engineering design specifications for structural steel detailing	*
MSATCS302A	Detail bolts and welds for structural steelwork connections	*

### Special requirements for the selection of Non-destructive Testing units

In order to ensure that the Certificate III in Engineering - Technical aligns to occupational outcomes in industry the following additional rules apply to the selection of the following units -

Only two (2) of the following units can be selected within the qualification:

MEM24001B	Perform basic penetrant testing	*
MEM24003B	Perform basic magnetic particle testing	*
MEM24005B	Perform basic eddy current testing	*

And, only one (1) of the following units can be selected within the qualification:

MEM24007B	Perform ultrasonic thickness testing	*
MEM24009B	Perform basic radiographic testing	*



## MEM30605 Certificate III in Jewellery Manufacture

### Modification History

Updated one unit of competency - MEM05006B to MEM05006C

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job packets, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, illustrations and renderings</li><li>• Check and clarify task-related information</li><li>• Recognise and use common jewellery and horological terminology</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions,</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>simple ratios and averages)</p> <ul style="list-style-type: none"> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Interpret design and fabrication requirements and translate into practical outcomes</li> <li>• Use diagnostic skills to identify and determine causes of problems</li> <li>• Diagnose precision micro-mechanisms</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Economise material use and minimise waste</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental guidelines and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> <li>• Assist with on the job training and assessment</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY****Technology**

- Select and use appropriate tools, equipment, materials and machines, including high tolerance/precision tools and equipment
- Use high magnification optics
- Use gem setting techniques, tools, processes and procedures
- Select and use appropriate measuring/testing devices
- Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications

**Packaging Rules**

The minimum requirements for achievement of the Certificate III in Jewellery Manufacture are:

- completion of all core units of competency listed below, and
- completion of Group A Jewellery Manufacture stream units from the list below to the value of at least 40 points, and
- completion of units from Group B Certificate III Trade specialisation units listed in Appendix I, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Jewellery Manufacture occupational outcomes

***Additional qualification descriptors***

There are no approved additional descriptors for this qualification.

## Core Units

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

## Electives

### Group A - Jewellery Manufacture stream units

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4

Unit code	Unit title	P
MEM03006B	Set assembly stations	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07005C	Perform general machining	8
MEM07024B	Operate and monitor machine/process	4
MEM07032B	Use workshop machines for basic operations	2
MEM07040A	Set multistage integrated processes	6
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM09002B	Interpret technical drawing	4
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM15004B	Perform inspection	2

Unit code	Unit title	P
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19008B	Prepare jewellery designs	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19013B	Produce jewellery metal masters	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19018B	Repair jewellery items	6

Unit code	Unit title	P
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6

**Group B -Trade Specialisation units**

Select units from Certificate III Trade Specialisation units listed in Appendix 1, Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites.

## MEM30705 Certificate III in Marine Craft Construction

### Modification History

Not Applicable

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or graphs and 3D shapes (lofting)</li><li>• Check and clarify task-related information</li><li>• Recognise and use common marine terminology</li><li>• Liaise with appropriate authorities</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Undertake numerical operations, geometry and calculations/formulae (including addition, subtraction, multiplication,</li></ul>



**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>division, fractions and decimals, percentages and proportions, simple ratios and averages)</p> <ul style="list-style-type: none"> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Translate designs into practical outcomes</li> <li>• Use diagnostic skills and tests to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Economise material use and minimise waste and negative environmental impacts</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate materials and adjustment of equipment</li> <li>• Inspect and prepare worksite</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>• Maintain current knowledge of applicable standards, legislation, environmental guidelines, codes of practice and product/process developments</li> <li>• Assist with on the job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of marine systems and engineering principles, techniques, procedures, tools and equipment to achieve the required outcome</li> <li>• Use CAD equipment</li> </ul>

**Packaging Rules**

The minimum requirements for achievement of the Certificate III in Marine Craft Construction are:

- completion of all core units of competency listed below, and
- completion of Group A Marine Craft Construction stream units from the list below to the value of at least 40 points, and
- completion of units from Group B - Certificate III Trade specialisation units listed in Appendix 1, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Marine Craft Construction occupational outcomes

***Additional qualification descriptors***

There are no approved additional descriptors for this qualification.

**Core Units**

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

**Elective Units****Group A - Marine Craft Construction stream units**

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
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Unit code	Unit title	P
MEM04018B	Perform general woodworking machine operations	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07024B	Operate and monitor machine/process	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08014B	Apply protective coatings (basic)	4
MEM09002B	Interpret technical drawing	4
MEM09021B	Interpret and produce curved 3-dimensional shapes	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4
MEM25004B	Fair and shape surfaces	2
MEM25005B	Construct and assemble marine vessel timber components	8

Unit code	Unit title	P
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25008B	Repair marine vessel surfaces and structures	4
MEM25009B	Form timber shapes using hot processes	2
MEM25010B	Perform fitout procedures	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25013B	Produce three-dimensional plugs/moulds	12
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2

### Group B - Trade Specialisation units

Select units from Certificate III Trade Specialisation units listed in Appendix I, Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites

## MEM30805 Certificate III in Locksmithing

### Modification History

Not Applicable

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or tables</li><li>• Check and clarify task-related information</li><li>• Recognise and use common locksmithing terminology</li><li>• Provide customer advice on locksmithing products and options</li><li>• Verify authenticity</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem-solving	<ul style="list-style-type: none"><li>• Undertake basic numerical operations and calculations/formulae (including addition, subtraction, multiplication,</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<p>division, fractions and decimals, percentages and proportions, simple ratios and averages)</p> <ul style="list-style-type: none"> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Analyse information according to enterprise and work requirements</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Use diagnostic skills and tests to identify and determine causes of problems</li> <li>• Decode lock/key mechanism</li> <li>• Produce key codes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate materials and adjustment of equipment</li> <li>• Establish entry requirements, authorisations and ownership</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation,</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	environmental requirements, codes of practice and product/process developments <ul style="list-style-type: none"> <li>• Assist with on the job training and assessment</li> <li>• Seek specialist advice on areas outside own competence</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of appropriate locksmithing principles, techniques, procedures, tools and equipment to achieve the required outcome</li> <li>• Apply knowledge of key systems and lock mechanisms</li> </ul>

**Packaging Rules**

The minimum requirements for achievement of the Certificate III in Locksmithing are:

- completion of all core units of competency listed below, and
- completion of Group A Locksmithing stream units from the list below to the value of at least 40 points, and
- completion of units from Group B Certificate III Trade specialisation units listed in Appendix 1, Volume 1 of the Training Package, to bring the total value to at least 73 points

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for Locksmithing occupational outcomes



**Additional qualification descriptors**

There are no approved additional descriptors for this qualification.

**Core Units**

- select all of the units from this list

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

**Elective Units****Group A - Locksmithing stream units**

- select units from this list to the value of at least 40 points

Unit code	Unit title	P
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Unit code	Unit title	P
MEM05007C	Perform manual heating and thermal cutting	2
MEM09002B	Interpret technical drawing	4
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM20005A	Install and maintain door control devices/systems	2
MEM20006A	Maintain and service mechanical locking devices	6
MEM20007A	Plan and prepare a masterkey system	4
MEM20008A	Develop and implement a masterkey system	6
MEM20009A	Gain entry and reinstate fire and security containers	4
MEM20010A	Gain entry and reinstate automotive locking systems	4
MEM20011A	Service and repair fire and security containers	6
MEM20012A	Service and repair mechanical automotive locking systems	4
MEM20013A	Service automotive transponder systems	2
MEM20014A	Perform a site security survey	2

## Group B - Trade Specialisation units

Select units from Certificate III Trade Specialisation units listed in Appendix 1, Volume 1 of MEM05 to bring the total value of units to at least 73 points, including any prerequisites.

## MEM30905 Certificate III in Boating Services

### Modification History

Release 3 - Title corrected for unit MEM05003B Perform soft soldering

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or graphs</li><li>• Check and clarify task-related information</li><li>• Recognise and use common boating terminology</li><li>• Follow verbal instructions</li><li>• Complete written and verbal reports</li><li>• Use boating communication systems, methods and signals to convey messages</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify and delegate work roles</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>• Demonstrate leadership skills</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Analyse information according to enterprise and work requirements</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Identify environmental issues and requirements applying to own work and that of others</li> <li>• Use diagnostic skills and tests to identify and determine causes of problems</li> <li>• Interpret weather forecasts</li> <li>• Use navigational aids to determine boat position</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> <li>• Assist the business to maintain the quality of the environment</li> <li>• Optimise material use and minimise waste</li> <li>• Implement emergency procedures to protect persons on board</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate materials and adjustment of equipment</li> <li>• Carry out trip preparation and planning</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental guidelines and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
	<ul style="list-style-type: none"> <li>• Follow emergency drills</li> <li>• Minimise impact on the environment</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Review and modify work progress to complement the work of others</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, materials, equipment and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Use navigation and communication systems and equipment</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Certificate III in Boating Services are:

- completion of all nine (9) core units of competency listed below, and
- completion of thirteen (13) elective units from the list below to bring the total number of units to twenty one (21).

Note that when selecting elective units any prerequisite units must also be completed and count towards the required number of elective units (refer to units for details).

Up to four appropriate electives may be chosen from other endorsed Training Packages and accredited courses where those units are available in a Certificate III. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Only select units that would be suitable for Boating Services occupational outcomes.

### *Additional qualification descriptors*

There are no approved additional descriptors for this qualification.

### **Core Units**

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM50001B	Classify recreational boating technologies and features
MEM50002B	Work safely on marine craft
MEM50003B	Follow work procedures to maintain the marine environment
MSAENV272B	Participate in environmentally sustainable work practices

**Elective units**

- Select 13 units from this list.

Unit code	Unit title
MEM04018B	Perform general woodworking machine operations
MEM05003B	Perform soft soldering
MEM05005B	Carry out mechanical cutting
MEM05007C	Perform manual heating and thermal cutting
MEM05012C	Perform routine manual metal arc welding
MEM05050B	Perform routine gas metal arc welding
MEM09002B	Interpret technical drawing

Unit code	Unit title
MEM11010B	Operate mobile load shifting equipment
MEM11011B	Undertake manual handling
MEM12023A	Perform engineering measurements
MEM12006C	Mark off/out (general engineering)
MEM12007D	Mark off/out structural fabrications and shapes
MEM13003B	Work safely with industrial chemicals and materials
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM25001B	Apply fibre-reinforced plastics
MEM25004B	Fair and shape surfaces
MEM25007B	Maintain marine vessel surfaces
MEM50004B	Maintain quality of environment by following marina codes
MEM50005B	Refuel vessels
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat
MEM50010B	Respond to boating emergencies and incidents
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)
TLILIC2001A	Licence to operate a forklift truck



# MEM31010 Certificate III in Watch and Clock Service and Repair

## Modification History

Not Applicable

## Description

This qualification has been specifically developed for apprentices in trades related to watch and clock servicing and repair and describes the skills and knowledge required to perform trade work in watch and clock service and repair. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off-the-job learning strategies. The qualification may also be achieved through formal skills recognition assessment processes.

### *Job roles/employment outcome*

The Certificate III in Watch and Clock Service and Repair specifies the competencies required for employment as a watch and clock service and repair tradesperson, including the disassembly, assembly, installation, adjustment, replacement, modification, testing, fault-finding, and maintenance and service of watch and clock cases, mechanisms and other relevant components.

Employment outcomes directly associated with this qualification are found in a variety of watch and clock service related businesses, including retail stores, manufacturer service centres and specialist watch and clock service and repair businesses, including self employment.

### *Application*

This qualification is designed to reflect the industry recognised skills profile associated with trade work as a watch and clock service and repair tradesperson. Skills development would typically be undertaken through an Australian Apprenticeship arrangement where the integration of on and off-the-job training would be specified in the Training Plan associated with the Training Contract between the employer and apprentice.

## Pathways Information

### *Pathways into the qualification*

There is no qualification entry requirement. It is assumed that the learner is engaged as an apprentice under a Training Contract and is involved in appropriate structured on-the-job learning while undertaking this qualification.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed MEM10105 Certificate I in Engineering, MEM20105 Certificate II in Engineering, MEM20205 Certificate II in Engineering - Production Technology or other qualifications relevant to watch and clock service and repair. Credit towards this qualification may also include units of competency contained within relevant pre-vocational and pre-apprenticeship programs and Statements of Attainment.

### ***Pathways from the qualification***

Further training pathways from this qualification include MEM40105 Certificate IV in Engineering and MEM50105 Diploma of Engineering - Advanced Trade or other relevant qualifications.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

### ***Licensing considerations***

There are no specific licences that relate to this qualification.

## **Licensing/Regulatory Information**

Refer to Pathways Information

## **Entry Requirements**

Not Applicable

## **Employability Skills Summary**

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
<b>Employability Skill</b>	<b>Industry/enterprise requirements for this qualification include:</b>
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job packets, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, illustrations and renderings</li><li>• Check and clarify task-related information</li><li>• Recognise and use common horological terminology</li></ul>

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Interpret service and repair requirements and translate into practical outcomes</li> <li>• Use diagnostic skills to identify and determine causes of problems</li> <li>• Diagnose precision micro-mechanisms</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Apply the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Economise material use and minimise waste</li> <li>• Participate in improvement procedures, including process, quality and internal/external customer/supplier relationships</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work, including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer recommendations and legislative requirements</li> <li>• Monitor performance of operation or quality of product or service to ensure customer satisfaction</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task-related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials, such as catalogues/lists as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> <li>• Assist with on-the-job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines, including high tolerance/precision tools and equipment</li> <li>• Use high magnification optics</li> <li>• Use watch and clock service and repair techniques, tools, processes and procedures</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access/input/store/retrieve/save and produce information/data using appropriate software applications</li> </ul>

## Packaging Rules

### Packaging rules

The minimum requirements for achievement of the Certificate III in Watch and Clock Service and Repair are:

- completion of all core units of competency listed below
- completion of elective units to a total value of at least 73 points, chosen as described below:
  - watch and clock stream units from Group A to the value of at least 40 points; and
  - trade specialisation units from Group B to bring the total value to at least 73 points.

Units with prerequisites are marked with an asterisk. Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Only select units that would be suitable for occupational outcomes in a watch and clock service and repair environment.

### Core units of competency

- Select all of the units from this list.

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

### Elective units of competency

#### Group A - Watch and Clock stream units

- Select units from this list to the value of at least 40 points.

Unit code	Unit title	P
MEM05001B	Perform manual soldering/desoldering, electrical/electronic components	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07005C	Perform general machining*	8
MEM09002B	Interpret technical drawing	4
MEM12002B	Perform electrical/electronic measurements	2
MEM18001C	Use hand tools	2
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange *	2
MEM21003A	Perform watch case servicing, repair and refurbishment *	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches *	2
MEM21006A	Service quartz watches *	4
MEM21007A	Service complex quartz watches *	4
MEM21008A	Service mechanical watches *	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches *	4
MEM21010A	Service watch power generating systems *	2
MEM21011A	Service calendar and other dial indication mechanisms for watches	4

Unit code	Unit title	P
	*	
MEM21012A	Service and repair mechanical watch oscillating systems *	4
MEM21013A	Service, test and adjust watch escapements *	4
MEM21014A	Service mechanical chronograph watches *	6
MEM21015A	Perform precision watch timing and adjustment *	6
MEM21016A	Install and set up clocks	2
MEM21017A	Service and repair clock timepieces	6
MEM21018A	Service clock escapements and oscillating systems *	4
MEM21019A	Service and repair clock striking mechanisms *	4
MEM21020A	Service and repair clock chiming mechanism *	6
MEM21021A	Restore clockwork mechanisms *	6
MEM21022A	Manufacture watch and clock components*	6
MEM21023A	Plan, set up and operate horological workshop or service centre	4
MEM30025A	Analyse a simple electrical system circuit*	4

### Group B - specialisation units

- Select units from the Certificate III Trade Specialisation units listed in Appendix I, Volume 1 of this Training Package to bring the total value of units to at least 73 points, including any prerequisites.
- Appropriate specialisation units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III.

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# MEM31112 Certificate III in Engineering - Composites Trade

## Modification History

Release 1 - new qualification

## Description

This qualification covers the skills and knowledge required by a tradesperson working with composites within the metal, engineering, manufacturing and associated industries, or other industries where composites tradespersons work. The qualification has been specifically developed to meet the needs of apprentices in the above trade. The qualification packaging has been developed on the assumption that competency will be developed through an integrated combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

### *Job roles/employment outcomes*

The MEM31112 Certificate III in Engineering - Composites Trade specifies the competencies required for employment as a composites tradesperson, including:

- laying up composites
- selecting and using materials and components for composite products
- handling, using and storing materials and components used in composites
- undertaking repairs and modifications to composite components
- undertaking repairs and modifications using composites
- adjusting resin chemicals for composite products and conditions
- selecting and using joining techniques.

People with this qualification may work in a large manufacturing organisation, a smaller workshop, a repair facility, a defence or a government facility. The composites tradesperson may work in a composites manufacturing or repair organisation, or they may work in an aerospace, civil construction, general manufacturing, marine, vehicle or other organisation as a composites specialist. They may be part of a large organisation or they may be an independent contractor performing composites trade work for other organisations. 'Composites' in this application refers to reinforced resin components and does not include geo-textile or other industrial textiles.

### *Application*

This qualification is designed to provide an industry recognised skills profile related to working as a composites tradesperson. Skills development would usually be undertaken through an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

This work will generally be undertaken in a factory or workshop environment but may also be undertaken onsite.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

## Pathways Information

### *Pathways into the qualification*

There is no qualification entry requirement. It is assumed that the learner is engaged as an apprentice under a Training Contract and that the learner is involved in appropriate structured on-the-job learning while undertaking this qualification.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed other relevant qualifications. Credit towards this qualification may also include units of competency contained within relevant pre-vocational and pre-apprenticeship programs and Statements of Attainment.

### *Pathways from the qualification*

Further training pathways from this qualification include MEM40105 Certificate IV in Engineering and MEM50105 Diploma of Engineering – Advanced Trade or other relevant qualifications.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

## Licensing/Regulatory Information

There are no specific licences that relate to this qualification.

## Entry Requirements

Not applicable.

## Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li></ul>

	<ul style="list-style-type: none"> <li>• Convey and share technical information</li> <li>• Produce sketches, diagrams, charts or graphs</li> <li>• Check and clarify task-related information</li> <li>• Recognise and use common fabrication terminology</li> <li>• Liaise with appropriate authorities</li> </ul>
<b>Teamwork</b>	<ul style="list-style-type: none"> <li>• Work alone or as part of a team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
<b>Problem solving</b>	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use appropriate measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Analyse information according to enterprise and work requirements</li> <li>• Assess operation and condition of components against specifications or manufacturer's requirements</li> <li>• Use diagnostic skills to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li> <li>• Translate designs into practical outcomes</li> </ul>
<b>Initiative and enterprise</b>	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures, including process, quality and internal/external customer/supplier relationships</li> <li>• Economise material use and minimise waste</li> </ul>
<b>Planning and organising</b>	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations/complete activities/scheduled production</li> <li>• Select and use planning techniques and tools</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work, including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
<b>Self-management</b>	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental guidelines and legislative requirements</li> <li>• Monitor performance of operation or quality of product or</li> </ul>

	service to ensure customer satisfaction <ul style="list-style-type: none"> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturer specifications</li> </ul>
<b>Learning</b>	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> <li>• Identify customers' requirements with respect to the operation or quality of the product or service</li> <li>• Assess and modify own work practices</li> <li>• Use manuals, online help and other reference materials, such as catalogues/lists, as required</li> <li>• Maintain current knowledge of applicable standards, legislation, codes of practice and product/process developments</li> <li>• Assist with on-the-job training and assessment</li> </ul>
<b>Technology</b>	<ul style="list-style-type: none"> <li>• Select and use appropriate tools, equipment, materials and machines</li> <li>• Select and use appropriate measuring/testing devices</li> <li>• Navigate technology to access/input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of appropriate engineering principles, techniques, procedures, tools and equipment to achieve the required outcome</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM31112 Certificate III in Engineering - Composites Trade are:

- completion of all core units of competency listed below
- completion of elective units to a total value of at least 73 points, chosen as described below:
  - basic composite fabrication units from Group A to the value of at least 12 points
  - composite trade specialisation units from Group B to the value of at least 28 points
  - units not already chosen from Group B and trade specialisation units from Group C to bring the total value to at least 73 points.

Units with prerequisites are marked with an asterisk. Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2).

Appropriate Group C elective units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the flexibility requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

### Core units of competency

- Select all units from this list.

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

### Elective units of competency

#### Group A – Composite fabrication units

- Select units from this list to the value of at least 12 points.

Unit code	Unit title	Points
MEM26001A	Lay up composites using open moulding techniques	6
MEM26002A	Lay up composites using vacuum closed moulding techniques	6
MEM26003A	Lay up composites using pressure closed moulding techniques	6

Group B - Composites trade specialisation units

- Select units from this list to the value of at least 28 points.

Unit code	Unit title	Points
MEM26004A	Make basic plugs for composites fabrication	3
MEM26005A	Make basic moulds for composites fabrication	3
MEM26006A	Mark and cut out sheets for composite use	4
MEM26007A	Select and use reinforcing appropriate for product	4
MEM26008A	Select and use resin systems appropriate for product	4
MEM26009A	Select and use cores and fillers appropriate for product	2
MEM26010A	Store and handle composite materials	2
MEM26011A	Determine materials and techniques for a composite component or product*	6
MEM26012A	Record and trial work processes for one-off composite products	4
MEM26013A	Select and use composite processes or systems appropriate for product	4
MEM26014A	Adjust resin chemicals for current conditions	4
MEM26015A	Select and apply repair techniques	6
MEM26016A	Select and use joining techniques	6
MEM26017A	Prepare composite or other substrate surfaces	4
MEM26018A	Organise composite trials	4

Unit code	Unit title	Points
MEM26019A	Finish a composite product	4
MEM26020A	Identify and interpret required standards for composites	2

#### Group C - specialisation units

- Select additional units from Group B or from the Certificate III Trade Specialisation units listed in Appendix I of this Training Package to bring the total value of units to at least 73 points, including any prerequisites.
- Appropriate specialisation units to the value of 16 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate III.
- 

### Custom Content Section

Not applicable.

## MEM40105 Certificate IV in Engineering

### Modification History

Release 4 - Imported elective unit AURV225908A replaced by AURVTN2002. No change in outcomes.

Updated one unit of competency - MEM05006B to MEM05006C

Minor formatting corrected

### Description

This qualification covers the skills and knowledge required for employment as a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson (Mechanical) - Level II, Special Class Engineering Tradesperson (Fabrication) - Level II, Special Class Engineering Tradesperson (Electrical/Electronic) - Level II within the metal, engineering, manufacturing and associated industries or at equivalent levels in other industries where Engineering Tradespersons work.

The qualification has been specifically developed to be delivered to people who are existing engineering tradespersons or delivered to apprentices in an Engineering Trade who choose to study at a higher level during their apprenticeship. The qualification packaging has been developed on an assumption that competency will be developed through an integrated combination of on and off-the-job learning strategies such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

#### *Job roles/employment outcomes*

The Certificate IV in Engineering specifies the competencies required for employment as a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson - Level II in mechanical, electrical/electronic or fabrication trade disciplines. The job role involves application of additional skills in the learner's trade or cross skills from other trades. Job roles may include the design, assembly, manufacture, installation, modification, testing, fault finding, commissioning, maintenance and service of equipment and machinery, the fabrication of structures and assemblies, manufacture of sheet metal work, as well as use of relevant machinery, equipment and joining techniques. Machinery and equipment can include fluid power systems, stationary and mobile equipment, instruments, refrigeration, and the use of computer controlled machine tools.

Employment outcomes related to this qualification are found in a wide variety of manufacturing and engineering related sectors as well as Higher Engineering Tradesperson or a Special Class Engineering Tradesperson - Level II related roles in other industries.



## ***Application***

This qualification is designed to provide an industry recognised skills profile related to trade work as a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson - Level II. Skills development would be undertaken through post-apprenticeship training or as part of an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

Occupational titles at the enterprise level covered by this qualification may vary and include special class engineering tradesperson - mechanical, fabrication or electrical/electronic, special class mechanical tradesperson, fitter and turner, fitter and machinist, maintenance fitter, diesel fitter, plant mechanic, 1<sup>st</sup> class machinist, special class metal fabrication tradesperson, boilermaker, sheet metal worker, welder, moulder, foundry tradesperson, patternmaker, or special class electrical fitter, electrical mechanic, electrical fitter/mechanic, electrician, refrigeration mechanic and radio tradesperson

## **Pathways Information**

### ***Pathways into the qualification***

While there is no qualification entry requirement, it is assumed that the learner is either already a tradesperson with access to structured on and off-the-job training, or is an apprentice under an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed MEM30205 Certificate III in Engineering - Mechanical Trade, MEM30305 Certificate III in Engineering - Fabrication Trade, MEM30405 Certificate III in Engineering - Electrical/Electronic Trade, MEM30605 Certificate III in Jewellery Manufacture, MEM30705 Certificate III in Marine Craft Construction, MEM30805 Certificate III in Locksmithing, MEM31010 Certificate III in Watch and Clock Service and Repair, or other relevant qualifications.

### ***Pathways from the qualification***

Further training pathways from this qualification include MEM50105 Diploma of Engineering - Advanced Trade or other relevant qualifications.

### ***Additional qualification advice***

An additional descriptor may be added to this qualification title to illustrate a particular skills profile.

This could be achieved by adding a pathway descriptor or sentence below the formal title of the qualification. Note that no changes may be made to the qualification title and the use of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

There are no specific requirements associated with the use of these descriptors other than their use should reflect the nature of the choice of units of competency in the qualification and must be consistent with the work role of a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson - Level II.

Reference to other occupational or functional pathways consistent with the role of a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson - Level II may be included on any qualification statement that is issued.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

### ***Licensing considerations***

If appropriate electives are undertaken as part of a contract of training recognised by licensing authorities, then this qualification can be used as the basis for an application in each state and territory for a license to practise as an electrician. It can also be used to satisfy regulations regarding refrigeration and air conditioning work. Local regulations should be checked for details.

## **Licensing/Regulatory Information**

Refer to Pathways Information

## **Entry Requirements**

Not Applicable

## **Employability Skills Summary**

<b>EMPLOYABILITY SKILLS QUALIFICATION SUMMARY</b>	
<b>Employability Skill</b>	<b>Industry/enterprise requirements for this qualification include:</b>
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>• Produce sketches, diagrams, charts or graphs</li> <li>• Check and clarify trade related information</li> <li>• Provide clear and precise information to others including trade team members, apprentices, production employees</li> <li>• Recognise and use common engineering terminology and symbols</li> <li>• Liaise with appropriate authorities</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a trade team</li> <li>• Contribute to a group effort in order to plan and carry out work</li> <li>• Identify work roles, communicate and cooperate with others</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use advanced measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Assess operation and condition of equipment against specifications or manufacturer's requirements</li> <li>• Analyse information from drawings, production data, manuals and reports from other employees to improve equipment performance</li> <li>• Use diagnostic skills and tests to identify and determine causes of faults, including interpretation of in-built fault indicators and error codes</li> <li>• Develop, implement and evaluate solutions to problems</li> <li>• Translate designs into practical outcomes</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including process, quality and internal/external customer/supplier relationships</li> <li>• Economise material and energy use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence maintenance and repair operations to ensure completion of activities within schedules and with minimal disruption to scheduled production</li> <li>• Plan allocation of work to others including apprentices, trades assistants to ensure efficiency and safety</li> <li>• Organise and analyse information relevant to work</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental and other legislative requirements</li> <li>Monitor performance of own and other's work to ensure customer satisfaction, efficiency and sustainability</li> <li>Take responsibility for own work outcomes</li> <li>Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>Check and clarify task related information with appropriate personnel or technical adviser</li> <li>Identify internal or external customer requirements with respect to the work to be performed</li> <li>Assess and modify own work practices</li> <li>Use workshop and equipment manuals, online help, and other reference materials such as catalogues/lists as required</li> <li>Maintain current knowledge of applicable standards, legislation, environmental and other codes of practice and product/process developments</li> <li>Assist with on the job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>Select, set up and use appropriate tools, equipment, materials and machines</li> <li>Select and use appropriate measuring and testing devices to ensure compliance with tolerances and other specifications</li> <li>Navigate technology to access /input /store/retrieve/save and produce information/data using appropriate software applications</li> <li>Apply knowledge of appropriate engineering principles, techniques, procedures, diagnostic methods, tools and equipment to achieve the required outcome</li> <li>Check equipment and instruments for accuracy</li> <li>Improve efficiency of machines and equipment in order to minimise waste</li> </ul>

**Packaging Rules**

The minimum requirements for achievement of the Certificate IV in Engineering are:

- completion of all core units of competency listed below, and

- completion of units from the Group A Specialisation electives listed below to the value of at least 12 points, and
- completion of Group B electives listed below to bring the total value to at least 109 points.

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2, Volume 1).

Appropriate Group B elective units to the value of 22 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate IV. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

### ***Additional qualification descriptors***

The following additional descriptors are approved for use with this qualification:

Refrigeration and Air Conditioning; Casting and Moulding; CNC programming; Fluid Power; Heavy Fabrication; Instrumentation; Maintenance; Marine Electronics; Mechatronics; Patternmaking; Robotics; Toolmaking; Welding, Watch and Clock Service and Repair.

### **Core Units**

- select all of the units from this list

<b>Unit code</b>	<b>Unit title</b>
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15024A	Apply quality procedures
MEM15002A	Apply quality systems

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

## Electives

### Group A- Specialisation units

- select units from this list to a value of at least 12 points and up to a maximum of 109 points

Unit code	Unit title	P
MEM04020A	Supervise individual ferrous melting and casting operation	4
MEM04021A	Supervise individual non ferrous melting and casting operation	4
MEM04022A	Examine appropriateness of methoding for mould design	4
MEM04023A	Undertake prescribed tests on foundry related materials	4
MEM05024B	Perform welding supervision	12
MEM05025C	Perform welding/fabrication inspection	12
MEM05026C	Apply welding principles	4
MEM05042B	Perform welds to code standards using flux core arc welding process	6

Unit code	Unit title	P
MEM05043B	Perform welds to code standards using gas metal arc welding process	6
MEM05044B	Perform welds to code standards using gas tungsten arc welding process	6
MEM05045B	Perform pipe welds to code standards using manual metal arc welding process	6
MEM05046B	Perform welds to code standards using manual metal arc welding process	6
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM05054A	Write basic NC/CNC programs for thermal cutting machines	4
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
MEM07022C	Program CNC wire cut machines	2
MEM07023C	Program and set up CNC manufacturing cell	6
MEM07039A	Write programs for industrial robots	4
MEM09004B	Perform electrical/electronic detail drafting	8
MEM09006B	Perform advanced engineering	4

Unit code	Unit title	P
	detail drafting	
MEM09007B	Perform advanced mechanical detail drafting	4
MEM09008B	Perform advanced structural detail drafting	4
MEM09009C	Create 2D drawings using computer aided design system	8
MEM09010C	Create 3D models using computer aided design system	4
MEM09023A	Create 3D code files using computer aided manufacturing system	6
MEM10007C	Modify control systems	6
MEM10008B	Undertake commissioning procedures for plant and/or equipment	4
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM12005B	Calibrate measuring equipment	6
MEM12025A	Use graphical techniques and perform simple statistical computations	2
MEM14001B	Schedule material deliveries	8
MEM14002B	Undertake basic process planning	8
MEM14003B	Undertake basic production scheduling	8
MEM15007B	Conduct product and/or process capability studies	6
MEM15008B	Perform advanced statistical	2



Unit code	Unit title	P
	quality control	
MEM15010B	Perform laboratory procedures	8
MEM15011B	Exercise external quality assurance	6
MEM15012B	Maintain/supervise application of quality procedures	4
MEM15015B	Examine trading practices	5
MEM15016B	Inspect pre-packed articles	8
MEM15017B	Use and maintain reference standards	3
MEM15018B	Investigate consumer complaints	6
MEM15019B	Conduct a field inspection	12
MEM15020C	Perform verification/certification or in-service inspection	12
MEM15021C	Conduct audits of servicing licensees and public weighbridge licensees	4
MEM15022B	Verify reference standards	8
MEM16001B	Give formal presentations and take part in meetings	2
MEM16003B	Provide advanced customer service	2
MEM16009A	Research and analyse engineering information	2
MEM16010A	Write reports	2
MEM16011A	Communicate with individuals and small groups	2
MEM16012A	Interpret technical specifications and manuals	4

Unit code	Unit title	P
MEM16013A	Operate in a self-directed team	2
MEM16014A	Report technical information	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18011C	Shut down and isolate machines/equipment	2
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18017C	Modify mechanical systems and equipment	8
MEM18019B	Maintain pneumatic systems	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18023B	Modify fluid power system operation	8
MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
MEM18053B	Modify fluid power control systems	6
MEM18054B	Fault find, test and calibrate instrumentation systems and	8

Unit code	Unit title	P
	equipment	
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18058C	Modify electronic equipment	4
MEM18059B	Modify electronic systems	4
MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems	8
MEM18061B	Maintain/calibrate complex control systems	8
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18065B	Diagnose and repair digital equipment and components	10
MEM18066B	Diagnose and repair microprocessor-based equipment	6
MEM18067B	Tune control loops - multi controller or multi element systems	6
MEM18069B	Maintain, repair instrumentation process control analysers	6
MEM18070C	Modify complex electrical circuits and systems	6
MEM18073A	Perform advanced equipment testing and diagnostics on mobile plant and equipment	8
MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	4
MEM18092B	Maintain and repair commercial and/or industrial refrigeration	6

Unit code	Unit title	P
	and/or air conditioning controls	
MEM18093B	Maintain and repair integrated industrial refrigeration and/or large air handling system controls	8
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2
MEM19008B	Prepare jewellery designs	6
MEM19013B	Produce jewellery metal masters	4
MEM19018B	Repair jewellery items	6
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6
MEM20008A	Develop and implement a masterkey system	6
MEM20011A	Service and repair fire and security containers	6
MEM20012A	Service and repair mechanical automotive locking systems	4
MEM20013A	Service automotive transponder systems	2
MEM21018A	Service clock escapements and oscillating systems	4
MEM21019A	Service and repair clock striking mechanisms	4
MEM21020A	Service and repair clock chiming mechanisms	6
MEM21021A	Restore clockwork mechanisms	6
MEM21022A	Manufacture watch and clock components	6
MEM21023A	Plan, set up and operate	4

Unit code	Unit title	P
	horological workshop or service centre	
MEM24002B	Perform penetrant testing	4
MEM24004B	Perform magnetic particle testing	4
MEM24006B	Perform eddy current testing	6
MEM24008B	Perform ultrasonic testing	6
MEM24010B	Perform radiographic testing	6
MEM24011B	Establish non-destructive tests	12
MEM24012C	Apply metallurgy principles	4
MEM25008B	Repair marine vessel surfaces and structures	4
MEM25013B	Produce three-dimensional plugs/moulds	12
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	4
MEM30025A	Analyse a simple electrical system circuit	4
MSATCM304A	Interpret binary phase diagrams	4

### Group B - elective units

- select units from this group to bring the total value of Group A and B units to 109 points, including any prerequisites.

Unit code	Unit title	P
AURVTN2002	Carry out panel repairs	4
BSBOHS502A	Participate in the management of the OHS information and data systems	2

Unit code	Unit title	P
BSBOHS601A	Develop a systematic approach to managing OHS	4
BSBOHS602A	Develop OHS information and data analysis and reporting and recording processes	2
BSBOHS603A	Analyse and evaluate OHS risk	4
ICTTC136B	Install, maintain and modify customer premises communications cabling: ACA Restricted Rule	6
ICTTC137B	Install, maintain and modify customer premises communications cabling: ACA Open Rule	6
MEA405A	Repair/modify aircraft composite material structure/components	4
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04005C	Produce moulds and cores by hand	16

Unit code	Unit title	P
	(jobbing)	
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2
MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04016C	Develop and manufacture precision models	6
MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	4
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering - electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4

Unit code	Unit title	P
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	2
MEM05009C	Perform automated thermal cutting	2
MEM05010C	Apply fabrication, forming and shaping techniques	8
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4
MEM05018C	Perform advanced welding using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4



Unit code	Unit title	P
MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
MEM05022C	Perform advanced welding using oxy acetylene welding process	6
MEM05023C	Weld using submerged arc welding process	4
MEM05036C	Repair/replace/modify fabrications	4
MEM05037C	Perform geometric development	6
MEM05038B	Perform advanced geometric development - cylindrical/rectangular	2
MEM05039B	Perform advanced geometric development - conical	2
MEM05040B	Perform advanced geometric development - transitions	4
MEM05041B	Weld using powder flame spraying	4
MEM05047B	Weld using flux core arc welding process	4
MEM05048B	Perform advanced welding using flux core arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6

Unit code	Unit title	P
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07002B	Perform precision shaping/planing/slotting operations	4
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM07009B	Perform precision jig boring operations	4
MEM07010B	Perform tool and cutter grinding operations	4
MEM07011B	Perform complex milling operations	4
MEM07012B	Perform complex grinding operations	4
MEM07013B	Perform machining operations using horizontal and/or vertical	4

Unit code	Unit title	P
	boring machines	
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2
MEM07021B	Perform complex lathe operations	4
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools and cutters	4
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent	4

Unit code	Unit title	P
	surface coating	
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6
MEM08020B	Electroplate decorative finishes	6

Unit code	Unit title	P
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09005B	Perform basic engineering detail drafting	8
MEM09011B	Apply basic engineering design concepts	6
MEM09021B	Interpret and produce curved 3-dimensional shapes	4
MEM09022A	Create 2D code files using computer aided manufacturing system	4
MEM10001C	Erect structures	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM10004B	Enter and change programmable controller operational parameters	2
MEM10005B	Commission programmable controller programs	4
MEM10006B	Install machine/plant	4
MEM10009B	Install refrigeration and air conditioning plant and equipment	4
MEM10010B	Install pipework and pipework assemblies	4
MEM10011B	Terminate and connect specialist cables	3
MEM10013A	Install split air conditioning systems and associated pipework	6

Unit code	Unit title	P
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2
MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4

Unit code	Unit title	P
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/moveable load shifting equipment	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12006C	Mark off/out (general engineering)	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12019B	Measure components using coordinate measuring machine	4
MEM12020B	Set and operate coordinate measuring machine	2
MEM12021B	Program coordinate measuring machine	4
MEM12022B	Program coordinate measuring machine (advanced)	2
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an	4

Unit code	Unit title	P
	enterprise	
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM13010A	Supervise occupational health and safety in an industrial work environment.	4
MEM13013B	Work safely with ionizing radiation	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18004B	Maintain and overhaul mechanical equipment	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6



Unit code	Unit title	P
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4
MEM18008B	Balance equipment	2
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18012B	Perform installation and removal of mechanical seals	2
MEM18013B	Perform gland packing	2
MEM18014B	Manufacture press tools and gauges	8
MEM18015B	Maintain tools and dies	4
MEM18018C	Maintain pneumatic system components	4
MEM18020B	Maintain hydraulic system components	4
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18031B	Diagnose and rectify low voltage starting systems	2
MEM18032B	Maintain induction/exhaust systems	4

Unit code	Unit title	P
MEM18033B	Perform engine bottom-end overhaul	4
MEM18034B	Perform engine top-end overhaul	8
MEM18035B	Diagnose and rectify braking systems	6
MEM18037B	Diagnose and rectify low voltage charging systems	2
MEM18038B	Maintain wheels and tyres	2
MEM18039B	Diagnose and rectify track type undercarriage	4
MEM18040B	Maintain suspension systems	4
MEM18041B	Maintain steering systems	4
MEM18042C	Diagnose and rectify manual transmissions	4
MEM18043C	Diagnose and rectify automatic transmissions	8
MEM18044C	Diagnose and rectify drive line and final drives	4
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18052B	Maintain fluid power systems for mobile plant	4

Unit code	Unit title	P
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18063B	Terminate signal and data cables	4
MEM18064B	Maintain instrumentation system components	6
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6
MEM18088B	Maintain and repair commercial air conditioning systems and components	4
MEM18089B	Maintain and repair central air handling systems	6
MEM18090B	Maintain and repair industrial refrigeration systems and components	6
MEM18094B	Service and repair commercial refrigeration	6
MEM18095A	Maintain and repair cooling towers/evaporative condensers and	4

Unit code	Unit title	P
	associated equipment	
MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	6
MEM18097A	Manufacture cavity dies	8
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service	6

Unit code	Unit title	P
	micro-mechanisms	
MEM20001A	Produce keys	4
MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM20005A	Install and maintain door control devices/systems	2
MEM20006A	Maintain and service mechanical locking devices	6
MEM20007A	Plan and prepare a masterkey system	4
MEM20009A	Gain entry and reinstate fire and security containers	4
MEM20010A	Gain entry and reinstate automotive locking systems	4
MEM20014A	Perform a site security survey	2
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange *	2
MEM21003A	Perform watch case servicing, repair and refurbishment *	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches *	2
MEM21006A	Service quartz watches *	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4

Unit code	Unit title	P
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21010A	Service watch power generating systems	2
MEM21011A	Service calendar and other dial indication mechanisms for watches	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21013A	Service, test and adjust watch escapements	4
MEM21014A	Service mechanical chronograph watches	6
MEM21015A	Perform precision watch timing and adjustment	6
MEM21016A	Install and set up clocks	2
MEM21017A	Service and repair clock timepieces	6
MEM24001B	Perform basic penetrant testing	2
MEM24003B	Perform basic magnetic particle testing	2
MEM24005B	Perform basic eddy current testing	2
MEM24007B	Perform ultrasonic thickness testing	2
MEM24009B	Perform basic radiographic testing	2
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4
MEM25004B	Fair and shape surfaces	2
MEM25005B	Construct and assemble marine vessel timber components	8

Unit code	Unit title	P
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25009B	Form timber shapes using hot processes	2
MEM25010B	Perform fitout procedures	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2
MSAENV472B	Implement and monitor environmentally sustainable work practices	4
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4

Unit code	Unit title	P
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-pregs	4
PRSTS202A	Install security equipment/system	4
PRSTS302A	Program security equipment/system	2
PRSTS303A	Test installed security equipment/system	2
PRSTS304A	Commission/decommission security equipment/system	2
PRSTS305A	Identify and diagnose electronic security equipment/ system fault	2
PRSTS307A	Maintain and service security equipment/system	4
PRSTS317A	Provide estimate and quote	4
PRSTS319A	Modify and repair security equipment/system	4
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1
TLILIC2001A	Licence to operate a forklift truck	0

The minimum requirements for this qualification can also be met by holders of one of the following qualifications or equivalent with the completion of additional units of competency drawn from Specialisation units Group A to a minimum value of 12 points and Specialisation units from Group B to bring the total value of additional units to at least 36 points (note that additional units are those units not included in the Certificate III qualification already held):

- MEM30105 Certificate III in Engineering - Production Systems
- MEM30205 Certificate III in Engineering - Mechanical Trade
- MEM30305 Certificate III in Engineering - Fabrication Trade
- MEM30405 Certificate III in Engineering - Electrical/Electronic Trade
- MEM30605 Certificate III in Jewellery Manufacture
- MEM30705 Certificate III in Marine Craft Construction
- MEM30805 Certificate III in Locksmithing



- MEM31010 Certificate III in Watch and Clock Service and Repair
- AUR30505 Certificate III in Marine
-

## MEM40205 Certificate IV in Boating Services

### Modification History

Release 2 - Title corrected for unit MEM05003B Perform soft soldering

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

Not Applicable

### Entry Requirements

Not Applicable

### Employability Skills Summary

EMPLOYABILITY SKILLS QUALIFICATION SUMMARY	
Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts and maps, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or graphs</li><li>• Check and clarify boating related information</li><li>• Provide clear and precise information to others including team members, customers and service personnel</li><li>• Recognise and use common marine terminology and symbols</li><li>• Liaise with appropriate authorities</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or lead or work as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

Problem-solving	<ul style="list-style-type: none"> <li>• Undertake numerical operations, calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)</li> <li>• Use measuring techniques</li> <li>• Inspect quality of own or other employee's work</li> <li>• Assess operation and condition of equipment against specifications or manufacturer's requirements</li> <li>• Analyse information from drawings, charts and maps, manuals and reports from other employees to improve service to customers</li> <li>• Develop, implement and evaluate solutions to problems</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures including activities to improve services, work processes, environmental impacts, quality and internal/external customer/supplier relationships</li> <li>• Economise material and energy use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence maintenance and repair operations to ensure completion of activities within schedules and with minimal disruption to scheduled production</li> <li>• Plan allocation of work to others including apprentices, trades assistants to ensure efficiency and safety</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work including selection of appropriate tools, equipment and materials and adjustment of equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, manufacturer's recommendations, environmental and other legislative requirements</li> <li>• Monitor performance of own and other's work to ensure customer satisfaction, efficiency and sustainability</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task related information with appropriate personnel or technical adviser</li> </ul>

**EMPLOYABILITY SKILLS QUALIFICATION SUMMARY**

	<ul style="list-style-type: none"> <li>Identify internal or external customer requirements with respect to the work to be performed</li> <li>Assess and modify own work practices</li> <li>Use workshop and equipment manuals, online help, and other reference materials such as catalogues/lists as required</li> <li>Maintain current knowledge of applicable standards, legislation, environmental and other codes of practice and product/process developments</li> <li>Assist with on the job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>Select, set up and use appropriate tools, equipment, materials and machines</li> <li>Select and use appropriate measuring and testing devices to ensure compliance with specifications</li> <li>Navigate technology to access , input, store, retrieve, save and produce information using appropriate software applications</li> <li>Apply knowledge of appropriate engineering principles, techniques, procedures, diagnostic methods, tools and equipment to achieve the required outcome</li> <li>Check equipment and instruments for faults and performance to specification</li> <li>Improve efficiency of machines and equipment in order to minimise waste</li> </ul>

**Packaging Rules**

The minimum requirements for achievement of the Certificate IV in Boating Services are:

- completion of ten (10) core units of competency listed below, and
- completion of nineteen (19) elective units from Groups A, B and C as described below to bring the total number of units to twenty nine (29).

Note that when selecting elective units any prerequisite units must also be completed and count towards the required number of elective units (refer to units for details).

Up to five appropriate elective units of competency may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Certificate IV. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Only select units that would be suitable for occupational outcomes in a marine environment.

***Additional qualification descriptors***

There are no approved additional descriptors for this qualification.

**Core Units**

- select all of the units from this list

Unit code	Unit title
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM50001B	Classify recreational boating technologies and features
MEM50002B	Work safely on marine craft
MEM50003B	Follow work procedures to maintain the marine environment
MEM50004B	Maintain quality of environment by following marina codes
MSAENV272B	Participate in environmentally sustainable work practices

**Elective units****Group A**

- select at least one unit from this list

Unit code	Unit title
MEM50005B	Refuel vessels

Unit code	Unit title
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat
MEM50010B	Respond to boating emergencies and incidents

### Group B

- select at least five units from this list

Unit code	Unit title
BSBCMN408A	Report on financial activity
BSBRKG301A	Control records
BSALF401A	Maintain trust accounts
BSBADM402A	Produce complex business documents
BSBCMN406A	Maintain business technology
BSBADM408A	Prepare financial reports
Any units from BSB40807 Certificate IV in Frontline Management may be selected. These units are not listed in this Volume. Please refer to the relevant host training package.	
Any units from TAE40110 Certificate IV in Training and Assessment. These units are not listed in this Volume. Please refer to the relevant host training package.	

### Group C

- select the balance of units from this list.

Unit code	Unit title
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Unit code	Unit title
MEM04018B	Perform general woodworking machine operations
MEM05003B	Perform soft soldering
MEM05005B	Carry out mechanical cutting
MEM05007C	Perform manual heating and thermal cutting
MEM05012C	Perform routine manual metal arc welding
MEM05050B	Perform routine gas metal arc welding
MEM09002B	Interpret technical drawing
MEM11010B	Operate mobile load shifting equipment
MEM11011B	Undertake manual handling
MEM12023A	Perform engineering measurements
MEM12006C	Mark off/out (general engineering)
MEM12007D	Mark off/out structural fabrications and shapes
MEM13003B	Work safely with industrial chemicals and materials
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM25001B	Apply fibre-reinforced materials
MEM25004B	Fair and shape surfaces
MEM25007B	Maintain marine vessel surfaces
MEM50005B	Refuel vessels
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat

Unit code	Unit title
MEM50010B	Respond to boating emergencies and incidents
MSAENV472B	Implement and monitor environmentally sustainable work practices

The minimum requirements for this qualification can also be met by holders of one of the following qualifications or equivalent subject to the completion of at least one additional Core unit of competency and seven additional Group A and Group B elective units of competency as specified below (note that additional units are those units not included in the Certificate III qualification already held):

- MEM30705 Certificate III in Marine Craft Construction
- MEM30905 Certificate III in Boating Services
- AUR30505 Certificate III in Marine
- LMT30407 Certificate III in Textile Fabrication

#### Core Units

- select this unit

Unit code	Unit title
MEM50001B	Classify recreational boating technologies and features

#### Elective units

#### Group A

- select one unit from this list

Unit code	Unit title
MEM50002B	Work safely on marine craft
MEM50003B	Follow work procedures to maintain the marine environment
MEM50004B	Maintain quality of environment by following marina codes
MEM50005B	Refuel vessels



Unit code	Unit title
MEM50006B	Check operational capability of marine craft
MEM50007B	Check operational capability of sails and sail operating equipment
MEM50008B	Carry out trip preparation and planning
MEM50009B	Safely operate a mechanically powered recreational boat
MEM50010B	Respond to boating emergencies and incidents

### Group B

- select six units from this list.

Unit code	Unit title
BSBCMN408A	Report on financial activity
BSBRKG301A	Control records
BSALF401A	Maintain trust accounts
BSBADM402A	Produce complex business documents
BSBCMN406A	Maintain business technology
BSBADM408A	Prepare financial reports
Any units from BSB40807 Certificate IV in Frontline Management. These units are not listed in this Volume. Please refer to the relevant host training package.	
Any units from TAE40110 Certificate IV in Training and Assessment. These units are not listed in this Volume. Please refer to the relevant host training package.	

## **MEM40311 Certificate IV in Advanced Jewellery Manufacture**

### **Modification History**

Release 2 - Imported elective unit BSBSMB405A replaced by BSBSMB405B. No change in outcomes.

Release 1 - New qualification

### **Description**

This qualification has been specifically developed to be delivered to people who are existing jewellery tradespersons or apprentices in a jewellery-related trade who choose to study at a higher level during their apprenticeship. The qualification packaging has been developed on an assumption that competency will be developed through a combination of on and off the job learning strategies. The qualification may also be achieved through formal skills recognition processes.

### **Job roles/employment outcomes**

The MEM40311 Certificate IV in Advanced Jewellery Manufacture specifies the competencies required for employment as a Higher Engineering Tradesperson or a Special Class Engineering Tradesperson – Level II in jewellery-related disciplines, Jeweller Tradesperson Special Class, or related classification depending on the Award or Agreement.

The job role involves application of additional skills in the jewellery trade including, gem setting, engraving or jewellery manufacturing skills. Employment outcomes related to this qualification are found in jewellery manufacturing and retail and wholesale jewellery enterprises.

### **Application**

This qualification is typically used to develop skill and knowledge in the application of specialised jewellery manufacturing trade and related skills within jewellery-related enterprises.

## Pathways Information

### Pathways into the qualification

This qualification may be accessed by direct entry. Credit for relevant units of competency should be granted towards this qualification for those who have completed MEM30605 Certificate III in Jewellery Manufacture, other relevant qualifications or achieved equivalent industry experience.

### Pathways from the qualification

Further training pathways from this qualification include design orientated training in the Diploma and Advanced Diploma in Jewellery and Object Design or management qualifications.

## Licensing/Regulatory Information

There are no specific licences that relate to this qualification. However, some units in this qualification may have licensing or regulatory requirements in some environments. Local regulations should be checked for details.

## Entry Requirements

Not applicable.

## Employability Skills Summary

### Certificate IV in Advanced Jewellery Manufacturing

The following table contains a summary of the Employability Skills as identified by the jewellery industry for this qualification. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this qualification. The outcomes described here are broad industry requirements that reflect skill requirements for this level.

Employability Skill	Industry/enterprise requirements for this qualification include:
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Communication	<ul style="list-style-type: none"> <li>• Establish and maintain effective relationships with industry representatives and clients</li> <li>• Interpret industry standards, regulations and policies</li> <li>• Undertake client discussion to determine work requirements and job specifications</li> <li>• Consult with supply chain personnel to determine resource supply capabilities</li> <li>• Calculate job costs</li> <li>• Negotiate with client to establish costing and job timeframes</li> <li>• Sketch designs</li> <li>• Accurately record and interpret detailed work specifications</li> <li>• Complete detailed and accurate documentation and maintain records</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Establish and maintain cooperative and consultative relationships with clients or colleagues</li> <li>• Work with others in the supply chain</li> <li>• Provide information and feedback to others to maintain production quality</li> <li>• Participate in sustainability improvements</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Examine risks and implement and maintain risk control measures for materials and equipment</li> <li>• Identify and report environmental features, regulations, insurance requirements, legal requirements and other factors which may affect the product or service to be provided</li> <li>• Determine and implement corrective measures for production problems and faults</li> <li>• Undertake maintenance of machinery and equipment</li> <li>• Determine work requirements and modifications</li> <li>• Assess quality of materials before using in work items</li> <li>• Produce cost-effective specifications in line with client expectations</li> <li>• Determine specific construction techniques to be used</li> <li>• Respond effectively to supply chain issues related to supply of resources</li> <li>• Investigate environmental performance and identify potential areas for improvement</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Develop continuous improvement of processes</li> <li>• Determine necessary adjustment to production techniques in line with specifications</li> <li>• Anticipate and address design and production issues</li> <li>• Investigate and apply new tools and strategies to improve resource use</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Undertake effective planning of own work to achieve</li> </ul>

	<p>desired outcomes within agreed timeframes</p> <ul style="list-style-type: none"> <li>• Undertake ordering of resources and materials to ensure work flows are met</li> <li>• Monitor quality processes and analyse outcomes</li> <li>• Determine and implement contingency plans to respond to incidents and problems</li> <li>• Monitor and maintain equipment condition and performance</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Manage own work plans and priorities</li> <li>• Manage client and industry relationships and contracts</li> <li>• Manage data flows and record keeping</li> <li>• Maintain housekeeping of workplace</li> <li>• Monitor and maintain own work against quality standards</li> <li>• Apply safety procedures, including the use of protective equipment</li> <li>• Monitor use of resources</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Assess own skill requirements and seek further development, if required</li> <li>• Develop or adjust own processes based on prior experience</li> <li>• Maintain currency of learning with regards to trends, jewellery design features and production techniques</li> <li>• Experiment with production techniques</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Monitor and maintain machine operation</li> <li>• Use machinery and equipment effectively, efficiently and safely</li> <li>• Use specialised computing equipment and software</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM40311 Certificate IV in Advanced Jewellery Manufacture are:

- completion of all twelve (12) core units of competency listed below, and
- completion of elective units as described below from Groups A and B, to bring the total value to at least 109 points.

Elective units are to be chosen as follows:

- completion of Group A electives to the value of at least 12 points
- completion of Group B electives to bring the total value of elective units to 109 points.

Appropriate elective units to the value of 22 points may be chosen from other endorsed

Training Packages and accredited courses where those units are available for inclusion at Certificate IV. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Units with prerequisites are marked with an asterisk. Note that when selecting elective units any prerequisite units must also be completed. Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2).

### Core units of competency

Complete all twelve (12) units of competency from this list.

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology

MEM17003A	Assist in the provision of on the job training
MSAENV272B	Participate in environmentally sustainable work practices

### Elective units of competency

#### Group A - Advanced Jewellery Specialisation units

Select units from this list to the value of at least 12 points and up to a maximum of 109 points.

Unit code	Unit title	Points
MEM19023A	Apply drawing and rendering techniques to jewellery or object design	4
MEM19024A	Use CAD to create and display 3D jewellery and object models	4
MEM19025A	Create and present designs for jewellery and other 3D objects	4
MEM19026A	Investigate quality and application of jewellery materials	2
MEM19028A	Select materials and new technologies for jewellery and 3D object design applications	2
MEM19031A	Produce renderings and technical drawings for jewellery and object design construction	2
MEM19033A	Create silversmithing objects	4
MEM19034A	Apply chain manufacture process	2
MEM19035A	Plan and apply casting techniques for jewellery and object designs	4
MEM19037A	Plan and implement chenier fabrication process	2
MEM19038A	Apply traditional techniques to jewellery and 3D object production	4
MEM19044A	Repair and restore antique jewellery	4

MEM19045A	Set gems in channel style settings	4
MEM19046A	Apply grain setting techniques	4
MEM19047A	Set gems in claw and bezel style settings	4
MEM19048A	Develop and apply complex borders and decorations for hand engraving	4
MEM19049A	Develop and apply heraldic designs for hand engraving	2
MEM19050A	Hand carve engraving work	4
MEM19051A	Construct multiple stone settings*	4
MEM19052A	Produce complex objects using silversmithing techniques*	4
MEM19053A	Create complex findings and mechanisms for jewellery items*	4
MEM19054A	Fabricate platinum jewellery items	4

### Group B - Jewellery Manufacture stream units

Select units from this group to bring the total value of Group A and B units to 109 points, including any prerequisites.

Unit code	Unit title	Points
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly*	4
MEM03003B	Perform sheet and plate assembly*	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03006B	Set assembly stations*	2
MEM05006C	Perform brazing and/or silver soldering	2
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	2
MEM07001B	Perform operational maintenance of	2



	machines/equipment*	
MEM07005C	Perform general machining	8
MEM07024B	Operate and monitor machine/process	4
MEM07032B	Use workshop machines for basic operations*	2
MEM07040A	Set multistage integrated processes*	6
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating*	4
MEM08003C	Perform electroplating operations*	6
MEM08010B	Manually finish/polish materials*	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means*	2
MEM09002B	Interpret technical drawing	4
MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13010A	Supervise occupational health and safety in an industrial work environment*	4
MEM15003B	Use improvement processes in team activities*	4
MEM15004B	Perform inspection	2
MEM15015B	Examine trading practices*	5
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM16011A	Communicate with individuals and small groups*	2

MEM16013A	Operate in a self-directed team*	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work*	4
MEM18055B	Dismantle, replace and assemble engineering components*	3
MEM19001B	Perform jewellery metal casting*	6
MEM19002B	Prepare jewellery illustrations*	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials*	6
MEM19005B	Produce three-dimensional precision items*	8
MEM19006B	Replace watch batteries*	1
MEM19007B	Perform gemstone setting*	6
MEM19008B	Prepare jewellery designs*	6
MEM19009B	Perform investment procedures for lost wax casting process*	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19013B	Produce jewellery metal masters*	4
MEM19014B	Perform hand engraving*	4
MEM19015B	Perform jewellery enamelling*	4
MEM19016B	Construct jewellery components*	4

MEM19017B	Fabricate jewellery items*	6
MEM19018B	Repair jewellery items*	6
MEM19020B	Fault-find and maintain micro-mechanisms*	4
MEM19021B	Diagnose and service micro-mechanisms*	6
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment	4
BSBSMB403A	Market the small business	4
BSBSMB405B	Monitor and manage business operations	4
BSBSMB406A	Manage small business finances	4

## Custom Content Section

Not applicable.

## MEM40412 Certificate IV in Engineering Drafting

### Modification History

Release 3 - Imported elective unit UEPMNT419A replaced by UEPMNT419B - no change in outcomes.

Release 2 - Competitive manufacturing (MSACM) units replaced by Competitive Systems and Practices units.

Release 1 - New qualification

### Description

This qualification covers the skills and knowledge required for a detail draftsman producing specialist engineering drawings within an engineering or manufacturing work environment.

#### Application

The qualification has been developed with manufacturing and engineering-related industry sectors as a focus and may be packaged to meet the specific needs of drafting in mechanical and machine construction and maintenance, steel fabrication, other fabrication services and assembly, mechanical services, electrical services, fluid power, piping assembly, and so on.

Application of this qualification involves producing detail drawings according to engineering design intent and required Australian Standards (AS). Skills required include use of computer-aided design (CAD) software functions and ability to apply industry and discipline specific knowledge to produce models, drawings and schematics for specialised engineering-related areas of industry. Skills required include knowledge of engineering principles for the specialised area as well as mathematics together with appropriate drafting skills. The qualification applies to drawings produced to specifications required by designers and to all relevant standards, including AS 1100.101–1992 Technical drawing – General principles. Skills covered may also include information gathering, such as on-site visits, calculations, consultations and research.

### Pathways Information

#### Pathways into the qualification

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved will be granted towards this qualification for those who have completed MEM30505 Certificate III in Engineering - Technical, or MSA30208 Certificate III in Manufacturing Technology, or other relevant qualifications.

#### Pathways from the qualification

Further training pathways from this qualification include the MSA50108 Diploma of Manufacturing Technology (Structural Steel Detailing stream) or the MEM50211 Diploma

of Engineering - Technical.

## Licensing/Regulatory Information

There are no specific licences that relate to this qualification.

## Entry Requirements

There are no entry requirements for this qualification.

## Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret, follow and communicate information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents</li><li>• Produce sketches, diagrams, charts or graphs</li><li>• Check and clarify work-related information</li><li>• Provide clear and precise information to others, including team members, apprentices and production employees</li><li>• Produce engineering drawings complete with all references and notations to communicate design detail</li><li>• Recognise and use common engineering terminology and symbols</li><li>• Liaise with appropriate authorities</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team</li><li>• Contribute to a group effort in order to plan and carry out work</li><li>• Identify work roles, communicate and cooperate with others</li></ul>
Problem solving	<ul style="list-style-type: none"><li>• Undertake numerical operations, geometry and calculations/formulae, including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages</li><li>• Use engineering measuring techniques</li><li>• Inspect quality of own or other employee's work</li><li>• Assess operation and condition of equipment against specifications</li><li>• Analyse information from drawings, design documents, manuals and reports</li></ul>

	<ul style="list-style-type: none"> <li>• Develop, implement and evaluate solutions to problems</li> <li>• Translate designs into drawing documents</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying the competency in new and different situations and contexts</li> <li>• Identify actual and foreseeable workplace hazards during course of work</li> <li>• Implement OHS risk management procedures</li> <li>• Modify work plan to overcome unforeseen difficulties or developments that occur as work progresses</li> <li>• Participate in improvement procedures, including process, quality and internal/external customer/supplier relationships</li> <li>• Economise material and energy use and minimise waste</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Plan, prioritise and sequence work operations to ensure completion of activities within schedules</li> <li>• Organise and analyse information relevant to work</li> <li>• Set up jobs prior to commencement of work, including selection of appropriate tools and equipment</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work safely and in accordance with company policy and procedures, environmental and other legislative requirements</li> <li>• Monitor performance of own and other's work to ensure customer satisfaction, efficiency and sustainability</li> <li>• Take responsibility for own work outcomes</li> <li>• Apply techniques, procedures, tools and equipment for compliance with project specifications</li> <li>• Ensure work complies with industry standards</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Check and clarify task-related information with appropriate personnel, engineer or designer</li> <li>• Identify internal or external customer requirements with respect to the work to be performed</li> <li>• Assess and modify own work practices</li> <li>• Use equipment manuals, online help and other reference materials, such as catalogues/lists, as required</li> <li>• Maintain current knowledge of applicable standards, legislation, environmental and other codes of practice and product/process developments</li> <li>• Assist with on-the-job training and assessment</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Select, set up and use appropriate tools and equipment</li> <li>• Select and use appropriate measuring devices to ensure compliance with tolerances and other specifications</li> <li>• Navigate technology to access/input/store/retrieve/save and produce information/data using appropriate software applications</li> <li>• Apply knowledge of appropriate engineering principles,</li> </ul>

	<p>techniques, procedures, diagnostic methods, tools and equipment to achieve the required outcome</p> <ul style="list-style-type: none"> <li>• Check equipment and instruments for accuracy</li> <li>• Improve efficiency of equipment in order to minimise waste</li> </ul>
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## Packaging Rules

To be awarded the MEM40412 Certificate IV in Engineering Drafting, competency must be achieved in **fifteen (15)** units of competency:

- **four (4)** core units of competency
- **eleven (11)** elective units of competency, chosen as described below.

### Prerequisites

Units marked with an asterisk have one or more prerequisite requirements. The prerequisites for these units are to be counted in the total number of units required in the elective group. Please refer to the individual units for details.

### Core units of competency

The following **four (4)** units must be chosen.

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16008A	Interact with computing technology
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment
MSAENV272B	Participate in environmentally sustainable work practices

### Elective units of competency

Select **eleven (11)** elective units:

- a minimum of **eight (8)** from Group A below
- the balance may be chosen from Group A or Group B General Electives.

A maximum of **two (2)** general electives may be imported from other qualifications in this Training Package, other endorsed Training Packages and accredited courses where those

units are available at Certificate III or IV level.

### Group A – Specialisation units

Unit code	Unit title	Prerequisites
MEM09002B	Interpret technical drawing	
MEM09201A	Work effectively in an engineering drafting workplace	
MEM09202A	Produce freehand sketches	
MEM09203A	Measure and sketch site information	
MEM09204A	Produce basic engineering detail drawings	*
MEM09205A	Produce electrical schematic drawings	*
MEM09206A	Produce drawings for mechanical services	*
MEM09207A	Produce drawings for reticulated services	*
MEM09208A	Detail fasteners and locking devices in mechanical drawings	*
MEM09209A	Detail bearings, seals and other componentry in mechanical drawings	*
MEM09210A	Create 3-D solid models using computer-aided design (CAD) system	*
MEM09211A	Produce drawings or models for industrial piping	*
MEM09212A	Produce detailed drawings of steel to non-steel connections	*
MEM09213A	Produce schematic drawings for hydraulic and pneumatic fluid power systems	*
MEM09216A	Interpret and produce curved 3-D shapes and patterns	
MEM09217A	Prepare plans for pipe and duct fabrication	*
MEM09218A	Participate in drafting projects for building	*



	services	
MEM09219A	Prepare drawings for fabricated sheet metal products	*
MEM09220A	Apply surface modelling techniques to 3-D drawings	*
MEM09221A	Create 3-D model assemblies using computer-aided design (CAD) system	*
MEM12023A	Perform engineering measurements	
MEM15001B	Perform basic statistical quality control	
MEM16014A	Report technical information	*
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM30032A	Produce basic engineering drawings	
MEM30033A	Use computer-aided design (CAD) to create and display 3-D models	*
CPCCOHS1001A	Work safely in the construction industry	
CPCPCM4002A	Estimate and cost work	
MSATCS301A	Interpret architectural and engineering design specifications for structural steel detailing	*
MSATCS302A	Detail bolts and welds for structural steelwork connections	*
MSATCS501A	Detail standardised structural connections	*
MSATCS502A	Detail structural steel members	*
MSATCS504A	Detail ancillary steelwork	*
UEPMNT419B	Perform civil drafting	
<b>Group B – General electives</b>		
<b>Unit code</b>	<b>Unit title</b>	<b>Prerequisites</b>

MEM05051A	Select welding processes	
MEM12024A	Perform computations	
MEM16003B	Provide advanced customer service	
MEM30005A	Calculate force systems within simple beam structures	*
MEM30006A	Calculate stresses in simple structures	*
MEM30007A	Select common engineering materials	
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications	
MEM30010A	Set up basic hydraulic circuits	
MEM30011A	Set up basic pneumatic circuits	
MEM30013A	Assist in the preparation of a basic workplace layout	
MEM30016A	Assist in the analysis of a supply chain	
MEM30019A	Use resource planning software systems in manufacturing	*
MEM30023A	Prepare a simple cost estimate for a manufactured product	
MEM30024A	Participate in quality assurance techniques	*
MEM30025A	Analyse a simple electrical system circuit	*
FDFOP2005A	Work in a socially diverse environment	
LMTGN4002A	Participate in product engineering	
MSS402002A	Sustain process improvements	
MSS402030A	Apply cost factors to work practices	
MSS402051A	Apply quality standards	

## Custom Content Section

Not applicable.

# MEM50105 Diploma of Engineering - Advanced Trade

## Modification History

Release 5 - Imported elective unit AURV225908A replaced by AURVTN2002. No change in outcomes.

Release 4 - Correction to packaging advice for holders of a Certificate IV (units to a maximum of 12 points from Group B, not Group C)

Release 3 - MEM05006B updated to MEM05006C and minor formatting correction

## Description

This qualification covers the skills and knowledge required for employment as an Advanced Engineering Tradesperson - Level II within the metal, engineering, manufacturing and associated industries or at equivalent levels in other industries where Engineering Tradespersons work. The qualification has been specifically developed to meet the needs of apprentices in an Engineering Trade who choose to study at a higher level during their apprenticeship in the above trade or for people who are existing engineering tradespersons.

The qualification packaging has been developed on an assumption that competency will be developed through an integrated combination of on and off-the-job learning strategies, such as those delivered through a formal apprenticeship. The qualification may also be achieved through formal skills recognition assessment processes.

## Job roles/employment outcomes

The Diploma of Engineering - Advanced Trade specifies the competencies required for employment as an Advanced Engineering Tradesperson - Level II in mechanical, electrical/electronic or fabrication trade disciplines.

The job role involves application of advanced system level skills in the learner's trade and may also include cross skills from other trades. Job roles may include the design, assembly, manufacture, installation, modification, testing, fault finding, commissioning, maintenance and service of mechanical, electrical or electronic systems including related equipment and machinery, fabrication of structures and assemblies requiring advanced manufacturing and assembly techniques, sheet metal work requiring advanced manufacturing and assembly techniques as well as use of relevant machinery, equipment and joining techniques. Machinery and equipment can include fluid power systems, stationary and mobile equipment, instruments, refrigeration, and the use of computer controlled machine tools.

Employment outcomes related to this qualification are found in a wide variety of manufacturing and engineering related sectors as well as Advanced Engineering

Tradesperson - Level II related roles in other industries.

## Application

This qualification is designed to provide an industry recognised skills profile related to trade work as an Advanced Engineering Tradesperson - Level II. Skills development would be undertaken through an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

Assessment of some units of competency must, where indicated, include evidence of the candidate's performance in a productive work environment where there is a sufficient range of appropriate tasks and materials to cover the scope of application of those units. All outcomes must reflect the standard of performance inherent in the job.

Occupational titles at the enterprise level covered by this qualification may vary and include Advanced Engineering Tradesperson - Level II in mechanical, fabrication or electrical/electronic, or advanced level of any of the following: mechanical tradesperson, fitter and turner, fitter and machinist, maintenance fitter, diesel fitter, plant mechanic, 1st class machinist, special class metal fabrication tradesperson, boilermaker, sheet metal worker, welder, moulder, foundry tradesperson, patternmaker, electrical fitter, electrical mechanic, electrical fitter/mechanic, electrician, refrigeration mechanic and radio tradesperson.

## Pathways Information

Pathways into the qualification

While there is no qualification entry requirement, it is assumed that the learner is either already a tradesperson with access to structured on and off-the-job training, or is an apprentice under an Australian Apprenticeship arrangement where the mix of on and off-the-job training would be specified in the Training Plan associated with the Contract of Training between the employer and apprentice.

This qualification may be accessed by direct entry. Credit for relevant units of competency achieved should be granted towards this qualification for those who have completed MEM40105 Certificate IV in Engineering, MEM30205 Certificate III in Engineering - Mechanical Trade, MEM30305 Certificate III in Engineering - Fabrication Trade, MEM30405 Certificate III in Engineering - Electrical/Electronic Trade, MEM30605 Certificate III in Jewellery Manufacture, MEM30705 Certificate III in Marine Craft

Construction, MEM30805 Certificate III in Locksmithing, or other relevant qualifications.

### **Pathways from the qualification**

Further training pathways from this qualification include transition into technical work through completion of the MEM60105 Advanced Diploma of Engineering or undertaking other relevant qualifications. Learners are advised that not all units of competency completed in the Diploma of Engineering - Advanced Trade carry credit into the MEM60105 Advanced Diploma of Engineering and the actual credit will depend on the choice of electives.

### **Additional qualification advice**

An additional descriptor may be added to this qualification title to illustrate a particular skills profile.

This could be achieved by adding a pathway descriptor or sentence below the formal title of the qualification. Note that no changes may be made to the qualification title and the use of one of these descriptors to a qualification does not change the qualification's formal title or unique national code.

There are no specific requirements associated with the use of these descriptors other than their use should reflect the choice of units of competency in the qualification and must be consistent with the work role of an Advanced Engineering Tradesperson - Level II.

Reference to other occupational or functional pathways consistent with the role of an Advanced Engineering Tradesperson - Level II may be included on any qualification statement that is issued.

Competitive Manufacturing qualifications are available for employees at this level who already possess trade and other technical skills and who require additional manufacturing practice skills above those available in this qualification.

## Licensing/Regulatory Information

If appropriate electives are undertaken this qualification can be used as the basis for an application in each state and territory for a license to practise as an electrician. It can also be used to satisfy regulations regarding refrigeration and airconditioning work. Local regulations should be checked for details.

## Entry Requirements

Not Applicable

## Employability Skills Summary

### MEM50105 Diploma of Engineering - Advanced Trade

The following table contains a summary of the Employability Skills as identified by the jewellery industry for this qualification. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this qualification. The outcomes described here are broad industry requirements that reflect skill requirements for this level.

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret and analyse information on specifications, design briefs, charts, lists, drawings and other applicable reference documents</li><li>• Access, organise and communicate information from reference texts, manufacturer's catalogues and industrial magazines, websites, use of phone, email and fax</li><li>• Apply interpersonal, negotiating and communicating skills in work situations</li><li>• Create reports, graphics, specifications and other documentation</li><li>• Use standard engineering drawing symbols, references, terminology and scientific notation</li><li>• Consult with clients, internal and external stakeholders and others to confirm specifications and discuss alternatives</li><li>• Prepare and disseminate information, instructions, work plans and other documentation</li></ul>
Teamwork	<ul style="list-style-type: none"><li>• Work alone or as part of a team including mixed discipline teams and teams made up of professionals, para-professionals, trade and production personnel</li><li>• Consult and liaise with interested parties</li><li>• Provide clear and precise information to team members</li></ul>

	<ul style="list-style-type: none"> <li>Continually monitor and review team performance</li> <li>Encourage and facilitate improvement suggestions from team members</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>Analyse and evaluate information and data from operations, processes, and test results according to enterprise and work requirements</li> <li>Apply mathematical techniques and scientific principles to solve engineering problems (Including arithmetic, algebraic expressions with one independent variable, two-dimensional geometry, trigonometry, linear functions, basic quadratic functions, basic statistical methods and statistical process control)</li> <li>Evaluate and rank engineering options and develop recommendations</li> <li>Apply strategies for minimising resource use, reductions in toxic material and hazardous chemical use</li> <li>Evaluate sustainability and environmental implications of processes and equipment</li> <li>Perform hazard and risk analysis</li> <li>Perform tests to analyse materials, operations and capabilities and detect faults</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>Be capable of applying skills and knowledge in new and different situations and contexts</li> <li>Use judgement and discretion when determining implications and making decisions</li> <li>Facilitate and capitalise on change and innovation</li> <li>Identify solutions and improvements and make recommendations</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>Organise, categorise and sequence information</li> <li>Plan, sequence and prioritise work operations</li> <li>Prepare, monitor and review work plans, schedules, programs and budgets</li> <li>Identify procedural steps for implementation, commissioning and maintenance purposes</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>Carry out work within given timeframe, process and quality constraints</li> <li>Carry out work safely and in accordance with company policy and procedures and legislative requirements</li> <li>Monitor work to ensure compliance with legislation, codes and national standards</li> </ul>
Learning	<ul style="list-style-type: none"> <li>Undertake research using manuals, online help and other reference materials as required</li> <li>Identify and consult appropriate technical personnel to obtain and verify information</li> </ul>



	<ul style="list-style-type: none"> <li>• Provide and communicate information to other team members</li> <li>• Maintain current knowledge of applicable standards, legislation, environmental and other codes of practice and product and process developments</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use computing technology to access, input and store information</li> <li>• Use a CAD program, computer and peripherals</li> <li>• Develop/customise, install, program, commission and maintain computer and control hardware and software</li> <li>• Identify and select common engineering materials by their principal properties</li> <li>• Select test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate for the engineering application</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the Diploma of Engineering - Advanced Trade are:

- completion of all of the Core units of competency listed below, and
- completion of Specialisation units from the Group A list below to a maximum value of 100 points, and
- completion of units up to the value of 12 points from the Group B list below and
- completion of units from the Group C list below to bring the total value of units from Groups A, B and C to at least 117 points.

Points associated with prerequisites count towards the total (refer to units and prerequisites listing in Appendix 2 in this Training Package).

Appropriate elective units to the value of 26 points may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Diploma. Note that the elective units listed below include all of the units that are approved for selection from the MEM Training Package for use in this qualification. This meets the NQC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Registered Training Organisations must seek a determination from Manufacturing Skills Australia in respect of the allocation of points values for units of competency drawn from other Training Packages or accredited courses.

Only select units that would be suitable for occupational outcomes in a manufacturing, engineering or related environment.

### Additional qualification descriptors

The following additional descriptors are approved for use with this qualification:  
Refrigeration and Air-conditioning; Casting and Moulding; CNC programming; Fluid Power; Heavy Fabrication; Instrumentation; Maintenance; Marine Electronics; Mechatronics; Patternmaking; Robotics; Toolmaking; Welding, Watch and Clock Service and Repair.

### Core units of competency

- select **all** of the units from this list.

Unit code	Unit title
MEM12023A	Perform engineering measurements
MEM12024A	Perform computations
MEM12025A	Use graphical techniques and perform simple statistical computations
MEM13014A	Apply principles of occupational health and safety in the work environment
MEM14004A	Plan to undertake a routine task
MEM14005A	Plan a complete activity
MEM15002A	Apply quality systems
MEM15024A	Apply quality procedures
MEM16006A	Organise and communicate information
MEM16007A	Work with others in a manufacturing, engineering or related environment
MEM16008A	Interact with computing technology
MEM16009A	Research and analyse engineering information
MEM16011A	Communicate with individuals and small groups
MEM16012A	Interpret technical specifications and manuals
MEM16014A	Report technical information
MEM17003A	Assist in the provision of on the job training
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related

MSAENV272B Participate in environmentally sustainable work practices

### Elective units of competency

#### Group A - Specialisation units

- select units from this list to a maximum value of 100 points

Unit code	Unit title	P
MEM03001B	Perform manual production assembly	4
MEM03002B	Perform precision assembly	4
MEM03003B	Perform sheet and plate assembly	4
MEM03004B	Perform electronic/electrical assembly (production)	8
MEM03005B	Rework and repair (electrical/electronic production)	8
MEM03006B	Set assembly stations	2
MEM04001B	Operate melting furnaces	4
MEM04002B	Perform gravity die casting	2
MEM04003B	Operate pressure die casting machine	4
MEM04004B	Prepare and mix sand for metal moulding	4
MEM04005C	Produce moulds and cores by hand (jobbing)	16
MEM04006B	Operate sand moulding and core making machines	8
MEM04007B	Pour molten metal	4
MEM04008B	Fettle and trim metal castings/forgings	4
MEM04010B	Develop and manufacture wood patterns	20
MEM04011B	Produce polymer patterns	8
MEM04012B	Assemble plated patterns	8
MEM04013B	Develop and manufacture polystyrene patterns	2

MEM04014B	Develop and manufacture production patterns	8
MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment	6
MEM04016C	Develop and manufacture precision models	6
MEM04017B	Develop and manufacture gear, conveyor screw and propeller patterns	4
MEM04018B	Perform general woodworking machine operations	4
MEM04019B	Perform refractory installation and repair	4
MEM05001B	Perform manual soldering/desoldering – electrical/electronic components	4
MEM05002B	Perform high reliability soldering and desoldering	4
MEM05003B	Perform soft soldering	2
MEM05004C	Perform routine oxy acetylene welding	2
MEM05005B	Carry out mechanical cutting	2
MEM05006B	Perform brazing and/or silver soldering	2
MEM05007C	Perform manual heating and thermal cutting	2
MEM05008C	Perform advanced manual thermal cutting, gouging and shaping	2
MEM05009C	Perform automated thermal cutting	2
MEM05010C	Apply fabrication, forming and shaping techniques	8
MEM05011D	Assemble fabricated components	8
MEM05012C	Perform routine manual metal arc welding	2
MEM05013C	Perform manual production welding	2
MEM05014C	Monitor quality of production welding/fabrications	2
MEM05015D	Weld using manual metal arc welding process	4
MEM05016C	Perform advanced welding using manual metal arc welding process	4
MEM05017D	Weld using gas metal arc welding process	4

MEM05018C	Perform advanced welding using gas metal arc welding process	4
MEM05019D	Weld using gas tungsten arc welding process	4
MEM05020C	Perform advanced welding using gas tungsten arc welding process	4
MEM05022C	Perform advanced welding using oxy acetylene welding process	6
MEM05023C	Weld using submerged arc welding process	4
MEM05036C	Repair/replace/modify fabrications	4
MEM05037C	Perform geometric development	6
MEM05038B	Perform advanced geometric development – cylindrical/rectangular	2
MEM05039B	Perform advanced geometric development – conical	2
MEM05040B	Perform advanced geometric development – transitions	4
MEM05041B	Weld using powder flame spraying	4
MEM05047B	Weld using flux core arc welding process	4
MEM05048B	Perform advanced welding using flux core arc welding process	4
MEM05049B	Perform routine gas tungsten arc welding	2
MEM05050B	Perform routine gas metal arc welding	2
MEM05051A	Select welding processes	2
MEM05052A	Apply safe welding practices	4
MEM06001B	Perform hand forging	4
MEM06002B	Perform hammer forging	4
MEM06003C	Carry out heat treatment	6
MEM06004B	Select heat treatment processes and test finished product	6
MEM06005B	Perform drop and upset forging	4
MEM06006C	Repair springs	4
MEM06007B	Perform basic incidental heat/quenching, tempering and	2

	annealing	
MEM06008A	Hammer forge complex shapes	4
MEM06009A	Hand forge complex shapes	4
MEM07001B	Perform operational maintenance of machines/equipment	2
MEM07002B	Perform precision shaping/planing/slotting operations	4
MEM07003B	Perform machine setting (routine)	4
MEM07004B	Perform machine setting (complex)	8
MEM07005C	Perform general machining	8
MEM07006C	Perform lathe operations	4
MEM07007C	Perform milling operations	4
MEM07008D	Perform grinding operations	4
MEM07009B	Perform precision jig boring operations	4
MEM07010B	Perform tool and cutter grinding operations	4
MEM07011B	Perform complex milling operations	4
MEM07012B	Perform complex grinding operations	4
MEM07013B	Perform machining operations using horizontal and/or vertical boring machines	4
MEM07014B	Perform electro-discharge (EDM) machining operations	4
MEM07015B	Set computer controlled machines/processes	2
MEM07021B	Perform complex lathe operations	4
MEM07024B	Operate and monitor machine/process	4
MEM07025B	Perform advanced machine/process operation	6
MEM07026B	Perform advanced plastic processing	6
MEM07027B	Perform advanced press operations	6
MEM07028B	Operate computer controlled machines/processes	2
MEM07029B	Perform routine sharpening/maintenance of production tools	4

	and cutters	
MEM07030C	Perform metal spinning lathe operations (basic)	8
MEM07031C	Perform metal spinning lathe operations (complex)	4
MEM07032B	Use workshop machines for basic operations	2
MEM07033B	Operate and monitor basic boiler	6
MEM07034A	Operate and monitor intermediate class boiler	4
MEM07040A	Set multistage integrated processes	6
MEM08001B	Perform wire, jig and barrel load/unload work	4
MEM08002C	Pre-treat work for subsequent surface coating	4
MEM08003C	Perform electroplating operations	6
MEM08004B	Finish work using wet, dry and vapour deposition methods	4
MEM08005B	Prepare and produce specialised coatings	4
MEM08006B	Produce clear and/or coloured and/or sealed anodised films on aluminium	2
MEM08007B	Control surface finish production and finished product quality	4
MEM08008B	Operate and control surface finishing waste treatment process	3
MEM08009C	Make up solutions	2
MEM08010B	Manually finish/polish materials	6
MEM08011B	Prepare surfaces using solvents and/or mechanical means	2
MEM08012B	Prepare surfaces by abrasive blasting (basic)	4
MEM08013B	Prepare surfaces by abrasive blasting (advanced)	4
MEM08014B	Apply protective coatings (basic)	4
MEM08015B	Apply protective coatings (advanced)	4
MEM08016B	Control blast coating by-products, materials and emissions	1
MEM08018B	Electroplate engineering coatings	6
MEM08019B	Electroplate protective finishes	6

MEM08020B	Electroplate decorative finishes	6
MEM09002B	Interpret technical drawing	4
MEM09003B	Prepare basic engineering drawing	8
MEM09005B	Perform basic engineering detail drafting	8
MEM09011B	Apply basic engineering design concepts	6
MEM09021B	Interpret and produce curved 3-dimensional shapes	4
MEM09022A	Create 2D code files using computer aided manufacturing system	4
MEM10001C	Erect structures	4
MEM10002B	Terminate and connect electrical wiring	3
MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.	12
MEM10004B	Enter and change programmable controller operational parameters	2
MEM10005B	Commission programmable controller programs	4
MEM10006B	Install machine/plant	4
MEM10009B	Install refrigeration and air conditioning plant and equipment	4
MEM10010B	Install pipework and pipework assemblies	4
MEM10011B	Terminate and connect specialist cables	3
MEM10013A	Install split air conditioning systems and associated pipework	6
MEM11001C	Erect/dismantle scaffolding and equipment	4
MEM11002C	Erect/dismantle complex scaffolding and equipment	4
MEM11003B	Coordinate erection/dismantling of complex scaffolding/equipment	4
MEM11004B	Undertake dogging	4
MEM11005B	Pick and process order	4
MEM11006B	Perform production packaging	2



MEM11007B	Administer inventory procedures	4
MEM11008B	Package materials (stores and warehouse)	2
MEM11009B	Handle/move bulk fluids/gases	4
MEM11010B	Operate mobile load shifting equipment	4
MEM11011B	Undertake manual handling	2
MEM11012B	Purchase materials	6
MEM11013B	Undertake warehouse receipt process	4
MEM11014B	Undertake warehouse dispatch process	4
MEM11015B	Manage warehouse inventory system	6
MEM11016B	Order materials	2
MEM11017B	Organise and lead stocktakes	4
MEM11018B	Organise and maintain warehouse stock receipt and/or dispatch system	6
MEM11019B	Undertake tool store procedures	4
MEM11020B	Perform advanced warehouse computer operations	4
MEM11021B	Perform advanced operation of load shifting equipment	2
MEM11022B	Operate fixed/movable load shifting equipment	4
MEM12001B	Use comparison and basic measuring devices	2
MEM12002B	Perform electrical/electronic measurement	2
MEM12006C	Mark off/out (general engineering)	4
MEM12007D	Mark off/out structural fabrications and shapes	4
MEM12019B	Measure components using coordinate measuring machine	4
MEM12020B	Set and operate coordinate measuring machine	2
MEM12021B	Program coordinate measuring machine	4
MEM12022B	Program coordinate measuring machine (advanced)	2

MEM13001B	Perform emergency first aid	1
MEM13002B	Undertake occupational health and safety activities in the workplace	3
MEM13003B	Work safely with industrial chemicals and materials	2
MEM13004B	Work safely with molten metals/glass	2
MEM13006B	Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise	4
MEM13007B	Maintain water treatment systems for cooling towers	2
MEM13010A	Supervise occupational health and safety in an industrial work environment.	4
MEM13013B	Work safely with ionizing radiation	4
MEM15001B	Perform basic statistical quality control	2
MEM15003B	Use improvement processes in team activities	4
MEM15004B	Perform inspection	2
MEM15005B	Select and control inspection processes and procedures	4
MEM16002C	Conduct formal interviews and negotiations	4
MEM16004B	Perform internal/external customer service	2
MEM16005A	Operate as a team member to conduct manufacturing, engineering or related activities	2
MEM18001C	Use hand tools	2
MEM18002B	Use power tools/hand held operations	2
MEM18003C	Use tools for precision work	4
MEM18004B	Maintain and overhaul mechanical equipment	4
MEM18005B	Perform fault diagnosis, installation and removal of bearings	4
MEM18006C	Repair and fit engineering components	6
MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies	4

MEM18008B	Balance equipment	2
MEM18009B	Perform levelling and alignment of machines and engineering components	4
MEM18012B	Perform installation and removal of mechanical seals	2
MEM18013B	Perform gland packing	2
MEM18014B	Manufacture press tools and gauges	8
MEM18015B	Maintain tools and dies	4
MEM18018C	Maintain pneumatic system components	4
MEM18020B	Maintain hydraulic system components	4
MEM18024B	Maintain engine cooling systems	2
MEM18025B	Service combustion engines	2
MEM18026C	Test compression ignition fuel systems	4
MEM18027C	Overhaul engine fuel system components	8
MEM18028B	Maintain engine lubrication systems	2
MEM18029B	Tune diesel engines	4
MEM18030B	Diagnose and rectify low voltage electrical systems	8
MEM18031B	Diagnose and rectify low voltage starting systems	2
MEM18032B	Maintain induction/exhaust systems	4
MEM18033B	Perform engine bottom-end overhaul	4
MEM18034B	Perform engine top-end overhaul	8
MEM18035B	Diagnose and rectify braking systems	6
MEM18037B	Diagnose and rectify low voltage charging systems	2
MEM18038B	Maintain wheels and tyres	2
MEM18039B	Diagnose and rectify track type undercarriage	4
MEM18040B	Maintain suspension systems	4

MEM18041B	Maintain steering systems	4
MEM18042C	Diagnose and rectify manual transmissions	4
MEM18043C	Diagnose and rectify automatic transmissions	8
MEM18044C	Diagnose and rectify drive line and final drives	4
MEM18045B	Fault find/repair electrical equipment/components up to 250 volts single phase supply	4
MEM18046B	Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.	10
MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant	4
MEM18048B	Fault find and repair/rectify basic electrical circuits	12
MEM18052B	Maintain fluid power systems for mobile plant	4
MEM18055B	Dismantle, replace and assemble engineering components	3
MEM18057B	Maintain/service analog/digital electronic equipment	6
MEM18063B	Terminate signal and data cables	4
MEM18064B	Maintain instrumentation system components	6
MEM18071B	Connect/disconnect fluid conveying system components	2
MEM18072B	Manufacture fluid conveying conductor assemblies	4
MEM18084A	Commission and decommission split air conditioning systems	4
MEM18085A	Install, service and repair domestic air conditioning and refrigeration appliances	6
MEM18086B	Test, recover, evacuate and charge refrigeration systems	4
MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment	6
MEM18088B	Maintain and repair commercial air conditioning systems and components	4
MEM18089B	Maintain and repair central air handling systems	6
MEM18090B	Maintain and repair industrial refrigeration systems and	6

	components	
MEM18094B	Service and repair commercial refrigeration	6
MEM18095A	Maintain and repair cooling towers/evaporative condensers and associated equipment	4
MEM18096A	Maintain, repair/replace and adjust refrigerant flow controls and associated equipment	6
MEM18097A	Manufacture cavity dies	8
MEM18098A	Prepare to perform work associated with fuel system installation and servicing*	2
MEM19001B	Perform jewellery metal casting	6
MEM19002B	Prepare jewellery illustrations	4
MEM19003B	Handle gem materials	2
MEM19004B	Handle and examine gemstone materials	6
MEM19005B	Produce three-dimensional precision items	8
MEM19006B	Replace watch batteries	1
MEM19007B	Perform gemstone setting	6
MEM19009B	Perform investment procedures for lost wax casting process	1
MEM19010B	Produce rubber moulds for lost wax casting process	2
MEM19011B	Perform wax injection of moulds for lost wax casting process	2
MEM19012B	Produce jewellery wax model	4
MEM19014B	Perform hand engraving	4
MEM19015B	Perform jewellery enamelling	4
MEM19016B	Construct jewellery components	4
MEM19017B	Fabricate jewellery items	6
MEM19020B	Fault-find and maintain micro-mechanisms	4
MEM19021B	Diagnose and service micro-mechanisms	6
MEM20001A	Produce keys	4

MEM20002A	Assemble and test lock mechanisms	6
MEM20003A	Install and upgrade locks and hardware	4
MEM20004A	Gain entry	4
MEM20005A	Install and maintain door control devices/systems	2
MEM20006A	Maintain and service mechanical locking devices	6
MEM20007A	Plan and prepare a masterkey system	4
MEM20009A	Gain entry and reinstate fire and security containers	4
MEM20010A	Gain entry and reinstate automotive locking systems	4
MEM20014A	Perform a site security survey	2
MEM21001A	Replace watch batteries, capacitors and bands	2
MEM21002A	Perform watch movement exchange *	2
MEM21003A	Perform watch case servicing, repair and refurbishment *	4
MEM21004A	Clean watch and clock components	2
MEM21005A	Diagnose faults in quartz watches *	2
MEM21006A	Service quartz watches *	4
MEM21007A	Service complex quartz watches	4
MEM21008A	Service mechanical watches	4
MEM21009A	Inspect, diagnose, adjust and repair mechanical watches	4
MEM21010A	Service watch power generating systems	2
MEM21011A	Service calendar and other dial indication mechanisms for watches	4
MEM21012A	Service and repair mechanical watch oscillating systems	4
MEM21013A	Service, test and adjust watch escapements	4
MEM21014A	Service mechanical chronograph watches	6
MEM21015A	Perform precision watch timing and adjustment	6

MEM21016A	Install and set up clocks	2
MEM21017A	Service and repair clock timepieces	6
MEM24001B	Perform basic penetrant testing	2
MEM24003B	Perform basic magnetic particle testing	2
MEM24005B	Perform basic eddy current testing	2
MEM24007B	Perform ultrasonic thickness testing	2
MEM24009B	Perform basic radiographic testing	2
MEM25001B	Apply fibre-reinforced materials	2
MEM25002B	Form and integrate fibre-reinforced structures	4
MEM25003B	Set up marine vessel structures	4
MEM25004B	Fair and shape surfaces	2
MEM25005B	Construct and assemble marine vessel timber components	8
MEM25006B	Undertake marine sheathing operations	2
MEM25007B	Maintain marine vessel surfaces	4
MEM25009B	Form timber shapes using hot processes	2
MEM25010B	Perform fitout procedures	4
MEM25011B	Install marine systems	8
MEM25012B	Install and test operations of marine auxiliary systems	6
MEM25014B	Perform marine slipping operations	2
MEM25015A	Assemble and install equipment and accessories/ancillaries	2
MEM50002B	Work safely on marine craft	1
MEM50003B	Follow work procedures to maintain the marine environment	1
MEM50004B	Maintain quality of environment by following marina codes	1
MEM50009B	Safely operate a mechanically powered recreational boat	2
AURVTN2002	Carry out panel repairs	4

BSBOHS502A	Participate in the management of the OHS information and data systems	2
BSBOHS601A	Develop a systematic approach to managing OHS	4
BSBOHS602A	Develop OHS information and data analysis and reporting and recording processes	2
BSBOHS603A	Analyse and evaluate OHS risk	4
ICTTC136B	Install, maintain and modify customer premises communications cabling: ACA Restricted Rule	6
ICTTC137B	Install, maintain and modify customer premises communications cabling: ACA Open Rule	6
MEA405A	Repair/modify aircraft composite material structure/components	4
PMBPROD291B	Operate resin infusion moulding equipment	2
PMBPROD294B	Operate resin transfer moulding equipment	2
PMBPROD298B	Operate equipment using pre-pregs material	2
PMBPROD391B	Produce composites using resin infusion	4
PMBPROD394B	Produce composites using resin transfer moulding	4
PMBPROD398B	Produce composites using pre-pregs	4
PRSTS202A	Install security equipment/system	4
PRSTS302A	Program security equipment/system	2
PRSTS303A	Test installed security equipment/system	2
PRSTS304A	Commission/decommission security equipment/system	2
PRSTS305A	Identify and diagnose electronic security equipment/system fault	2
PRSTS307A	Maintain and service security equipment/system	4
PRSTS317A	Provide estimate and quote	4
PRSTS319A	Modify and repair security equipment/system	4
TLILIC0012A	Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)	1



TLILIC2001A	Licence to operate a forklift truck	0
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### Group B - Specialisation units (optional)

- Units up to the value of 12 points may be selected from this list.

Unit code	Unit title	P
MEM05026C	Apply welding principles	4
MEM05042B	Perform welds to code standards using flux core arc welding process	6
MEM05043B	Perform welds to code standards using gas metal arc welding process	6
MEM05044B	Perform welds to code standards using gas tungsten arc welding process	6
MEM05045B	Perform pipe welds to code standards using manual metal arc welding process	6
MEM05046B	Perform welds to code standards using manual metal arc welding process	6
MEM05053A	Set and edit computer controlled thermal cutting machines	4
MEM05054A	Write basic NC/CNC programs for thermal cutting machines	4
MEM07016C	Set and edit computer controlled machines/processes	4
MEM07018C	Write basic NC/CNC programs	4
MEM07019C	Program NC/CNC machining centre	2
MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre	2
MEM07022C	Program CNC wire cut machines	2
MEM12003B	Perform precision mechanical measurement	2
MEM12004B	Perform precision electrical/electronic measurement	4
MEM18011C	Shut down and isolate machines/equipment	2

MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.	3
MEM18050C	Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.	3
MEM18054B	Fault find, test and calibrate instrumentation systems and equipment	8
MEM18056B	Diagnose and repair analog equipment and components	10
MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements	8
MEM18065B	Diagnose and repair digital equipment and components	10
MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls	6

### Group C - Specialisation units

- Select units from this list to bring the total value of the Specialisation units chosen from Groups A, B and C to 117 points, including any prerequisites.

Unit code	Unit title	P
MEM05024B	Perform welding supervision	12
MEM05025C	Perform welding/fabrication inspection	12
MEM07023C	Program and set up CNC manufacturing cell	6
MEM07039A	Write programs for industrial robots	4
MEM09004B	Perform electrical/electronic detail drafting	8
MEM09006B	Perform advanced engineering detail drafting	4
MEM09007B	Perform advanced mechanical detail drafting	4
MEM09008B	Perform advanced structural detail drafting	4
MEM09009C	Create 2D drawings using computer aided design system	8
MEM09010C	Create 3D models using computer aided design system	4

MEM09023A	Create 3D code files using computer aided manufacturing system	6
MEM10007C	Modify control systems	6
MEM10008B	Undertake commissioning procedures for plant and/or equipment	4
MEM12005B	Calibrate measuring equipment	6
MEM14001B	Schedule material deliveries	8
MEM14002B	Undertake basic process planning	8
MEM14003B	Undertake basic production scheduling	8
MEM15007B	Conduct product and/or process capability studies	6
MEM15008B	Perform advanced statistical quality control	2
MEM15010B	Perform laboratory procedures	8
MEM15011B	Exercise external quality assurance	6
MEM15012B	Maintain/supervise application of quality procedures	4
MEM15015B	Examine trading practices	5
MEM15016B	Inspect pre-packed articles	8
MEM15017B	Use and maintain reference standards	3
MEM15018B	Investigate consumer complaints	6
MEM15019B	Conduct a field inspection	12
MEM15020C	Perform verification/certification or in-service inspection	12
MEM15021C	Conduct audits of servicing licensees and public weighbridge licensees	4
MEM15022B	Verify reference standards	8
MEM16001B	Give formal presentations and take part in meetings	2
MEM16003B	Provide advanced customer service	2
MEM16010A	Write reports	2

MEM16013A	Operate in a self-directed team	2
MEM17001B	Assist in development and deliver training in the workplace	2
MEM17002B	Conduct workplace assessment	2
MEM18010C	Perform equipment condition monitoring and recording	4
MEM18016B	Analyse plant and equipment condition monitoring results	4
MEM18017C	Modify mechanical systems and equipment	8
MEM18019B	Maintain pneumatic systems	4
MEM18021B	Maintain hydraulic systems	4
MEM18022B	Maintain fluid power controls	8
MEM18023B	Modify fluid power system operation	8
MEM18051B	Fault find and repair/rectify complex electrical circuits	6
MEM18053B	Modify fluid power control systems	6
MEM18058C	Modify electronic equipment	4
MEM18059B	Modify electronic systems	4
MEM18060B	Maintain, repair control instrumentation – single and multiple loop control systems	8
MEM18061B	Maintain/calibrate complex control systems	8
MEM18066B	Diagnose and repair microprocessor-based equipment	6
MEM18067B	Tune control loops – multi controller or multi element systems	6
MEM18069B	Maintain, repair instrumentation process control analysers	6
MEM18070C	Modify complex electrical circuits and systems	6
MEM18073A	Perform advanced equipment testing and diagnostics on mobile plant and equipment	8
MEM18091B	Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems	4
MEM18093B	Maintain and repair integrated industrial refrigeration and/or large air handling system controls	8

MEM19008B	Prepare jewellery designs	6
MEM19013B	Produce jewellery metal masters	4
MEM19018B	Repair jewellery items	6
MEM19022B	Perform precision micro-mechanism diagnosis and servicing	6
MEM20008A	Develop and implement a masterkey system	6
MEM20011A	Service and repair fire and security containers	6
MEM20012A	Service and repair mechanical automotive locking systems	4
MEM20013A	Service automotive transponder systems	2
MEM21018A	Service clock escapements and oscillating systems	4
MEM21019A	Service and repair clock striking mechanisms	4
MEM21020A	Service and repair clock chiming mechanisms	6
MEM21021A	Restore clockwork mechanisms	6
MEM21022A	Manufacture watch and clock components	6
MEM21023A	Plan, set up and operate horological workshop or service centre	4
MEM24002B	Perform penetrant testing	4
MEM24004B	Perform magnetic particle testing	4
MEM24006B	Perform eddy current testing	6
MEM24008B	Perform ultrasonic testing	6
MEM24010B	Perform radiographic testing	6
MEM24011B	Establish non-destructive tests	12
MEM24012C	Apply metallurgy principles	4
MEM25008B	Repair marine vessel surfaces and structures	4
MEM25013B	Produce three-dimensional plugs/moulds	12
MEM30025A	Analyse a simple electrical circuit	4
MSAENV472B	Implement and monitor environmentally sustainable work	4

	practices	
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The minimum requirements for this qualification can also be met by holders of one of the following qualifications or equivalent subject to the completion of the Core units of competency as specified for this Diploma as well as additional Specialisation units of competency drawn from Specialisation units Group A to a maximum value of 24 points and Specialisation units in Group B and Group C (units to a maximum of 12 points may be selected from Group B) to bring the total value of additional units to at least 44 points (note that additional units are those units not included in the Certificate III qualification already held):

- MEM30105 Certificate III in Engineering - Production Systems
- MEM30205 Certificate III in Engineering - Mechanical Trade
- MEM30305 Certificate III in Engineering - Fabrication Trade
- MEM30405 Certificate III in Engineering - Electrical/Electronic Trade
- MEM30605 Certificate III in Jewellery Manufacture
- MEM30705 Certificate III in Marine Craft Construction
- MEM30805 Certificate III in Locksmithing
- MEM31010 Certificate III in Watch and Clock Service and Repair.
- AUR30305 Certificate III in Marine

In addition to the above, the minimum requirements for this qualification can also be met by holders of the MEM40105 Certificate IV in Engineering subject to the completion of the Mandatory units of competency as specified above as well as additional Specialisation units drawn from Specialisation units Group A to bring the total value of additional units to at least 8 points. Where higher level Core units (i.e. those required beyond Certificate IV) were included in the Certificate IV as Specialisation units then additional Specialisation units from Group C to the same points value will also be need to be completed.

## MEM50212 Diploma of Engineering - Technical

### Modification History

Release 4 - Removal of superseded unit from Group B electives (MEM14082A replaced in V9 by MEM14090A). Equivalent.

Release 3 - Imported elective unit UEPMNT419A replaced by UEPMNT419B. No change in outcomes.

Release 2 - ISC correction - MEM09141A and MEM09142A removed from packaging rules (units superseded and replaced in version 9)

### Description

Not applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

There are no specific licences that relate to this qualification. However, for employment at paraprofessional levels in the aeronautical and avionic fields in the Australian aviation industry, the Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA) have requirements that must be met. Units designed to meet these requirements are included as electives in this qualification. Advice on the selection of electives to meet ADF and CASA requirements is given at the end of this qualification.

### Entry Requirements

Not applicable

### Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret and analyse information on specifications, design briefs, charts, lists, drawings and other applicable reference documents</li><li>• Research, organise, analyse and communicate complex information from reference texts, manufacturer's catalogues and industrial magazines, websites, use of phone, email and fax</li></ul>

	<ul style="list-style-type: none"> <li>• Communicate effectively across a range of communication networks in the workplace, including attending meetings and facilitating small group discussions and meetings on relevant engineering and trade related issues, writing memos or letters, making telephone calls</li> <li>• Produce, interpret and analyse engineering drawings, charts and graphs</li> <li>• Prepare and disseminate verbal or written technical information, instructions, work plans, reports, specifications and other documentation</li> <li>• Identify, access, interpret and analyse trade related information in an enterprise, including quality documentation, equipment manufacturer specifications, engineering data sheets, production and maintenance records and national standards</li> <li>• Use engineering terminology and language appropriate to the situation and target audience</li> <li>• Write technical or non-technical reports that include some level of analysis and/or research</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of a team that may include apprentices, other tradespersons, technicians, engineers and production personnel</li> <li>• Provide clear and precise information to team members</li> <li>• Delegate and supervise work where appropriate</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Analyse information and data from operations, processes, and test results including determining trends from graphical data</li> <li>• Develop solutions and recommendations to trade related problems based on analysis of data</li> <li>• Apply mathematical techniques and scientific principles to engineering situations (including arithmetic, algebraic expressions with one independent variable, two-dimensional geometry, trigonometry, linear functions, basic quadratic functions, basic statistical methods and statistical process control)</li> <li>• Perform hazard and risk analysis</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying trade-related skills and knowledge in new and different situations and contexts</li> <li>• Apply statistical processes to make recommendations solutions for equipment and process improvements or to improve sustainability of operations</li> <li>• Make modifications to work plans and schedules to overcome unforeseen difficulties or developments</li> <li>• Initiate significant modifications to plant and equipment that lead to desired changes in performance</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Organise, sort, categorise and sequence information</li> <li>• Select and use planning techniques and tools to plan, sequence</li> </ul>



	and prioritise work operations <ul style="list-style-type: none"> <li>• Prepare, monitor and review work plans, schedules, programs and budgets</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Carry out work within given timeframe, process and quality constraints</li> <li>• Carry out work safely and in accordance with company policy and procedures and legislative requirements</li> <li>• Monitor work to ensure compliance with legislation, codes and national standards</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Use manuals, online help and other reference materials as required to research technical information and data suitable and appropriate for advanced trade and technician applications</li> <li>• Identify and consult appropriate personnel and technical experts or other reference sources to obtain/verify information</li> <li>• Provide and communicate information to other team members</li> <li>• Provide on the job training and monitor trainee progress</li> <li>• Maintain knowledge of relevant legislative requirements, codes and standards</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use computing technology to access, input and store information</li> <li>• Apply engineering knowledge and principles</li> <li>• Search computer databases and internet for technical information and data suitable and appropriate for advanced trade applications</li> <li>• Inspect engineering plant, equipment and systems for optimum operation and undertake modifications as required</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM50212 Diploma of Engineering - Technical are:

- completion of the **five (5)** core units of competency listed below, and
- **fifteen (15)** elective units, to bring the total number of units to **twenty (20)**.

Elective units must be selected as follows:

- up to **eight (8)** general elective units from the list in Group A
- at least **seven (7)** specialist elective units from Group B, to bring the total number of elective units to **fifteen (15)**.

**Three (3)** appropriate Group B electives may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Diploma level. Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Note that when selecting elective units any prerequisite units must also be completed. Note that prerequisites can only count towards the number of electives required if they are listed in the groups below (refer to units for details).

### Additional qualification descriptors

The following additional descriptors are approved for use with this qualification: Mechanical, Mechatronics, Manufacturing, Maintenance, Aeronautical and Avionic.

### Core units

- Select all of the units from this list.

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16008A	Interact with computing technology
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment
MSAENV272 B	Participate in environmentally sustainable work practices

### Electives units

Group A - general electives

- Select up to **eight (8)** units from this list.

Unit code	Unit title	Prerequisites
MEM09002B	Interpret technical drawing	
MEM09202A	Produce freehand sketches	

Unit code	Unit title	Prerequisites
MEM09203A	Measure and sketch site information	
MEM09204A	Produce basic engineering detail drawings	*
MEM09205A	Produce electrical schematic drawings	*
MEM09206A	Produce drawings for mechanical services	*
MEM09207A	Produce drawings for reticulated services	*
MEM09208A	Detail fasteners and locking devices in mechanical drawings	*
MEM09209A	Detail bearings, seals and other componentry in mechanical drawings	*
MEM09211A	Produce drawings or models for industrial piping	*
MEM09212A	Produce detailed drawings of steel to non-steel connections	*
MEM09213A	Produce schematic drawings for hydraulic and pneumatic fluid power systems	*
MEM09216A	Interpret and produce curved 3-D shapes and patterns	
MEM09217A	Prepare plans for pipe and duct fabrication	*
MEM09218A	Participate in drafting projects for building services	*
MEM09219A	Prepare drawings for fabricated sheet metal products	*
MEM12024A	Perform computations	
MEM13013B	Work safely with ionizing radiation	
MEM15001B	Perform basic statistical quality control	
MEM16003B	Provide advanced customer service	
MEM16012A	Interpret technical specifications and manuals	
MEM16014A	Report technical information	
MEM18001C	Use hand tools	
MEM24001B	Perform basic penetrant testing	*

Unit code	Unit title	Prerequisites
MEM24003B	Perform basic magnetic particle testing	*
MEM24005B	Perform basic eddy current testing	*
MEM24007B	Perform ultrasonic thickness testing	*
MEM24009B	Perform basic radiographic testing	*
MEM30005A	Calculate force systems within simple beam structures	*
MEM30006A	Calculate stresses in simple structures	*
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications	
MEM30009A	Contribute to the design of basic mechanical systems	*
MEM30010A	Set up basic hydraulic circuits	
MEM30011A	Set up basic pneumatic circuits	
MEM30013A	Assist in the preparation of a basic workplace layout	
MEM30014A	Apply basic just in time systems to the reduction of waste	
MEM30015A	Develop recommendations for basic set up time improvements	
MEM30016A	Assist in the analysis of a supply chain	
MEM30017A	Use basic preventative maintenance techniques and tools	
MEM30018A	Undertake basic process planning	
MEM30019A	Use resource planning software systems in manufacturing	
MEM30020A	Develop and manage a plan for a simple manufacturing related project	
MEM30021A	Prepare a simple production schedule	
MEM30022A	Undertake supervised procurement activities	
MEM30023A	Prepare a simple cost estimate for a manufactured	

Unit code	Unit title	Prerequisites
	product	
MEM30024A	Participate in quality assurance techniques	*
MEM30025A	Analyse a simple electrical system circuit	*
MEM30026A	Select and test components for simple electronic switching and timing circuits	*
MEM30027A	Prepare basic programs for programmable logic controllers	
MEM30028A	Assist in sales of technical products/systems	
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM30032A	Produce basic engineering drawings	
MEM30033A	Use computer-aided design (CAD) to create and display 3-D models	*
CPCCOHS1001A	Work safely in the construction industry	
MEA101B	Interpret occupational health and safety practices in aviation maintenance	
MEA105C	Apply quality standards applicable to aviation maintenance processes	*
MEA107B	Interpret and use aviation maintenance industry manuals and specifications	
MEA108B	Complete aviation maintenance industry documentation	*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance	*
MEA270A	Lay out avionic systems	*
MEA271A	Lay out avionic flight management systems	*
MEA340A	Lay out and set up aircraft systems	*
MEA341A	Apply basic aircraft design characteristics	*
MSAENV472B	Implement and monitor environmentally sustainable	

Unit code	Unit title	Prerequisites
	work practices	
MSATCS301A	Interpret architectural and engineering design specifications for structural steel detailing	*
MSATCS302A	Detail bolts and welds for structural steelwork connections	*
UEPMNT419B	Perform civil drafting	
Prerequisites:	Where a unit has prerequisites then those prerequisite units can only be used in the count towards the total number of units where they are listed in the table above.	

#### Group B - specialist electives

- Select at least **seven (7)** units from this list to bring the total number of elective units to **fifteen (15)**.

Unit code	Unit title	Prerequisites
MEM09011B	Apply basic engineering design concepts	
MEM09210A	Create 3-D solid models using computer-aided design (CAD) system	*
MEM09214A	Perform advanced engineering detail drafting	*
MEM09215A	Supervise detail drafting projects	*
MEM09220A	Apply surface modelling techniques to 3-D drawings	*
MEM09221A	Create 3-D model assemblies using computer-aided design (CAD) system	*
MEM09222A	Interpret and maintain or restore original drawings	*
MEM09143A	Represent aeronautical engineering designs	*
MEM09144A	Represent avionic engineering designs	*
MEM09155A	Prepare mechanical models for computer-aided engineering (CAE)	*

Unit code	Unit title	Prerequisites
MEM09156A	Prepare mechatronic models for computer-aided engineering (CAE)	*
MEM09157A	Perform mechanical engineering design drafting	
MEM09158A	Perform mechatronics engineering design drafting	
MEM12005B	Calibrate measuring equipment	*
MEM12022B	Program coordinate measuring machines (advanced)	*
MEM12025A	Use graphical techniques and perform simple statistical computations	*
MEM13010A	Supervise occupational health and safety in an industrial work environment	*
MEM14001B	Schedule material deliveries	
MEM14002B	Undertake basic process planning	
MEM14003B	Undertake basic production scheduling	
MEM14081A	Apply mechanical engineering fundamentals to support design and development of projects	*
MEM14083A	Apply aeronautical fundamentals to support design and development of engineering projects	*
MEM14084A	Apply avionic fundamentals to support design and development of engineering projects	*
MEM14085A	Apply mechanical engineering analysis techniques	
MEM14086A	Apply mechatronic engineering analysis techniques	
MEM14087A	Apply manufactured product design techniques	*
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications	*
MEM14089A	Integrate mechanical fundamentals into an engineering task	*
MEM14090A	Integrate mechatronic fundamentals into an engineering task	*

Unit code	Unit title	Prerequisites
MEM14091A	Integrate manufacturing fundamentals into an engineering task	*
MEM14092A	Integrate maintenance fundamentals into an engineering task	*
MEM15007B	Conduct product and/or process capability studies	*
MEM15008B	Perform advanced statistical quality control	*
MEM15010B	Perform laboratory procedures	
MEM15011B	Exercise external quality assurance	*
MEM15012B	Maintain/supervise the application of quality procedures	*
MEM18016B	Analyse plant and equipment condition monitoring results	*
MEM22002A	Manage self in the engineering environment	*
MEM22012A	Coordinate resources for an engineering project or operation	
MEM22013A	Coordinate engineering projects	
MEM22014A	Coordinate engineering-related manufacturing operations	*
MEM22015A	Source and estimate engineering materials requirements	
MEM22017A	Coordinate continuous improvement and technical development	
MEM22018A	Coordinate sales and promotion of engineering-related products or services	
MEM23003A	Operate and program computers and/or controllers in engineering situations	*
MEM23004A	Apply technical mathematics	
MEM23006A	Apply fluid and thermodynamics principles in engineering	*
MEM23007A	Apply calculus to engineering tasks	*
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	



Unit code	Unit title	Prerequisites
MEM23063A	Select and test mechanical engineering materials	*
MEM23064A	Select and test mechatronic engineering materials	*
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques	*
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques	*
MEM23109A	Apply engineering mechanic principles	*
MEM23111A	Select electrical equipment and components for engineering applications	*
MEM23112A	Investigate electrical and electronic controllers in engineering applications	*
MEM23139A	Design a basic single zone duct distribution system	*
MEM23140A	Determine operational parameters for building HVAC hydronic systems	*
MEM23142A	Determine psychrometric processes and system performance	*
MEM23143A	Apply energy management principles	*
MEM23145A	Apply codes and regulations to air conditioning designs	*
MEM23148A	Develop energy management solutions	*
MEM23151A	Commission and optimise performance of HVAC/R systems	*
MEM23152A	Apply principles of refrigeration food storage technology	
MEM23154A	Analyse and service HVAC/R control systems	*
MEM24002B	Perform penetrant testing	*
MEM24004B	Perform magnetic particle testing	*
MEM24006B	Perform eddy current testing	*
MEM24008B	Perform ultrasonic testing	*

Unit code	Unit title	Prerequisites
MEM24010B	Perform radiographic testing	*
MEM24011B	Establish non-destructive tests	*
MEM24012C	Apply metallurgy principles	
MEM30029A	Use workshop equipment and processes to complete an engineering project	
CPPBDN5013A	Develop and collaborate on building information models for small-scale building design projects	
MEA272B	Apply basic scientific principles and techniques in avionic engineering situations	
MEA273A	Select and test avionic engineering materials	
MEA342A	Apply basic aircraft power plant design characteristics	*
MEA349B	Apply basic scientific principles and techniques in aeronautical engineering situations	
MEA350A	Select and test aeronautical engineering materials	
MSS403010A	Facilitate change in an organisation implementing competitive systems and practices	
MSS405010A	Manage relationships with non-customer external organisations	
MSS405011A	Manage people relationships	
MSS405012A	Manage workplace learning	
MSS403001A	Implement competitive systems and practices	
MSS403002A	Ensure process improvements are sustained	
MSS405001A	Develop competitive systems and practices for an organisation	
MSS405002A	Analyse and map a value stream	
MSS405003A	Manage a value stream	
MSS405004A	Develop business plans in an organisation implementing	

Unit code	Unit title	Prerequisites
	competitive systems and practices	
MSS402030A	Apply cost factors to work practices	
MSS402060A	Use planning software systems in operations	
MSS402061A	Use SCADA systems in operations	
MSS402080A	Undertake root cause analysis	
MSS403021A	Facilitate a Just in Time system	
MSS403030A	Improve cost factors in work practices	
MSS403032A	Analyse manual handling processes	
MSS403040A	Facilitate and improve implementation of 5S	
MSS404050A	Undertake process capability improvements	*
MSS403051A	Mistake proof an operational process	
MSS404052A	Apply statistics to operational processes	
MSS404060A	Facilitate the use of planning software systems in a work area or team	
MSS404061A	Facilitate the use of SCADA systems in a team or work area	
MSS404081A	Undertake proactive maintenance analyses	
MSS404082A	Assist in implementing a proactive maintenance strategy	
MSS405020A	Develop quick changeover procedures	
MSS405021A	Develop a Just in Time system	
MSS405030A	Optimise cost of product or service	
MSS405031A	Undertake value analysis of a product or process costs in terms of customer requirements	
MSS405040A	Manage 5S system in an organisation	
MSS405050A	Determine and improve process capability	*

Unit code	Unit title	Prerequisites
MSS405060A	Develop the application of enterprise control systems in an organisation	
MSS405061A	Determine and establish information collection requirements and processes	
MSS405070A	Develop and manage sustainable energy practices	
MSS405075A	Facilitate the development of a new product	*
MSS405081A	Develop a proactive maintenance strategy	
MSATCS501A	Detail standardised structural connections	*
MSATCS502A	Detail structural steel members	*
MSATCS503A	Incorporate structural steel detailing into fabrication and construction project management	
MSATCS504A	Detail ancillary steelwork	*
Prerequisites:	Where a unit has prerequisites then those prerequisite units can only be used in the count towards the total number of units where they are listed in the table above.	

In addition to the above, the minimum requirements for this qualification can also be met by holders of the MEM30505 Certificate III in Engineering -Technical or equivalent subject to the completion of the specified Core units of competency as well as the additional elective units drawn from Group B.

### **Packaging advice to meet Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA) requirements**

In order to meet the requirements of both Regulators for employment as para-professionals in aeronautical and avionic fields in the Australian aviation industry, electives must be selected as described below for the Aeronautical and Avionic streams.

#### **Aeronautical stream**

- Select the following seven (7) units from Group A.

MEA101B	Interpret occupational health and safety practices in aviation maintenance
---------	--

MEA105C	Apply quality standards applicable to aviation maintenance processes*
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA108B	Complete aviation maintenance industry documentation*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals*
MEA340A	Lay out and set up aircraft systems*
MEA341A	Apply basic aircraft design characteristics*

- Select the following seven (7) units from Group B.

MEA342A	Apply basic aircraft power plant design characteristics*
MEA349B	Apply basic scientific principles and techniques in aeronautical engineering situations
MEA350A	Select and test aeronautical engineering materials
MEM09143A	Represent aeronautical engineering designs*
MEM14083A	Apply aeronautical fundamentals to support design and development of engineering projects*
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques*

To bring the total number of electives to fifteen (15), one (1) additional unit can be chosen from Groups A or B, or from Diploma level units in the MEA11 Aeroskills Training Package.

### Avionic stream

- Select the following seven (7) units from Group A

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA105C	Apply quality standards applicable to aviation maintenance processes*
MEA107B	Interpret and use aviation maintenance industry manuals and specifications

MEA108B	Complete aviation maintenance industry documentation*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals*
MEA270A	Lay out avionic systems*
MEA271A	Lay out avionic flight management systems*

- Select the following five (5) units from Group B

MEA272B	Apply basic scientific principles and techniques in avionic engineering situations
MEA273A	Select and test avionic engineering materials
MEM09144A	Represent avionic engineering designs*
MEM14084A	Apply avionic fundamentals to support design and development of engineering projects*
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques*

To bring the total number of electives to fifteen (15), another three (3) units are to be selected as follows:

- a minimum of two (2) additional units must be chosen from Group B
- a maximum of one (1) additional unit can be chosen from Group A, or from Diploma level units in the MEA11 Aeroskills Training Package.
-

# MEM50311 Diploma of Jewellery and Object Design

## Modification History

Release 5 - Imported elective units replaced by current versions.

Release 4 - Elective unit MEM22006A replaced by MEM22015A in Group C.

Release 3 - Elective unit MEM30001A replaced by MEM30031A

Release 2 - CUV unit codes corrected in Group D

## Description

This qualification describes the skills and knowledge required to apply design processes and technical production skills to the design and manufacture of custom-made jewellery and objects.

### Job roles/employment outcomes

This qualification targets those producing designs for jewellery which are likely to be for custom manufacture. It also includes skills required to produce designs according to the design brief. This person is likely to be employed in a production workshop or small business operation and working directly with clients to produce items as a designer/maker.

### Application

This qualification is typically used to develop skills and knowledge in jewellery enterprises. Skills gained from this qualification may be applied to specialist jewellery and object design briefs, including heritage jewellery, theatre and film commissions, exhibitions and churchware, as well as one-off individual client briefs.

## Pathways Information

### Pathways into the qualification

This qualification may be accessed by direct entry. Credit will be granted towards this qualification to those who have completed MEM30605 Certificate III in Jewellery Manufacture, MEM40311 Certificate IV in Advanced Jewellery Manufacture (under development) or who can demonstrate equivalent vocational experience.

### Pathways from the qualification

Further training pathways from this qualification include MEM60211 Advanced Diploma of Jewellery and Object Design.

## Licensing/Regulatory Information

There is no direct link between this qualification and licensing, legislative and/or regulatory requirements. However, all work must comply with occupational health and safety (OHS) and environmental regulations and legislation that apply to the workplace.

## Entry Requirements

Not applicable.

## Employability Skills Summary

### Diploma of Jewellery and object design

The following table contains a summary of the employability skills as identified by the jewellery and object design industry for this qualification. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this qualification. The outcomes described here are broad industry requirements that reflect skill requirements for this level.

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Interpret and implement relevant industry and workplace standards, regulations and policies</li> <li>• Complete design documentation in a range of formats, including drawings, specifications and plans</li> <li>• Use communication technologies efficiently</li> <li>• Interpret and document design brief and specifications</li> <li>• Discuss and explore problems with items and designs</li> <li>• Discuss design requirements with clients and others in the design or production team</li> <li>• Maintain accurate and legible records</li> <li>• Establish effective working relationships with colleagues</li> <li>• Present design ideas</li> <li>• Complete computer aided and manual drawings</li> <li>• Interact and network with industry participants</li> <li>• Interpret information on production techniques and materials</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work independently and as a team member</li> <li>• Demonstrate and encourage others in working cooperatively with people of different ages, gender, race or religion</li> <li>• Support others in the design process</li> <li>• Undertake appropriate and effective communication with others in the design process</li> <li>• Provide and obtain feedback on processes, outcomes and</li> </ul>



	<ul style="list-style-type: none"> <li>specifications to support and improve team outcomes</li> <li>Participate in sustainability improvements</li> </ul>
Problem solving	<ul style="list-style-type: none"> <li>Identify risks and implement risk control measures for machinery, equipment and processes</li> <li>Identify and address problems and faults</li> <li>Check performance of machinery and equipment and perform minor maintenance as required</li> <li>Assess and evaluate skill requirements of self and others to perform tasks</li> <li>Deal with and promptly resolve issues</li> <li>Use problem-solving techniques to determine design requirements and production specifications</li> <li>Apply knowledge of materials and processes to solve design problems</li> <li>Assess quality of materials before using in items</li> <li>Test designs and production specifications</li> <li>Identify and report potential environmental hazards</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>Test procedures and design concepts to assess effectiveness in meeting objectives</li> <li>Provide leadership in design and production processes</li> <li>Collect and analyse information to guide design and business practices</li> <li>Identify non-conformances to standards and initiate appropriate action</li> <li>Identify and implement effective ways to achieve design and production outcomes</li> <li>Rectify problems promptly and appropriately</li> <li>Monitor and adjust activities in response to operational variations</li> <li>Identify and address existing and potential risks</li> <li>Provide leadership in continuous improvement practices</li> <li>Assess and apply sustainable practices to work</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>Monitor quality outcomes</li> <li>Determine production requirements and plans for designs</li> <li>Plan processes to achieve desired outcomes within agreed timeframes</li> <li>Ensure workstation and equipment are set up so that work requirements are met</li> <li>Manage design processes</li> <li>Produce design samples</li> <li>Develop and implement contingency plans when responding to incidents and problems</li> <li>Identify and monitor resource use in own work</li> </ul>

Self-management	<ul style="list-style-type: none"> <li>• Maintain own work efficiency</li> <li>• Ensure the work area is kept clean and tidy at all times</li> <li>• Manage work load priorities</li> <li>• Monitor own work against workplace, industry and quality standards</li> <li>• Adjust processes or techniques as required according to variations in requirements</li> <li>• Conduct work in a manner which minimises waste</li> <li>• Implement and apply OHS practices in the workplace</li> <li>• Check accuracy of own documented information</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Experiment with design ideas and review outcomes</li> <li>• Seek feedback on ideas and work outcomes</li> <li>• Assess own skill requirements and seek further development if required</li> <li>• Develop or adjust processes based on previous experience</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use appropriate tools, machines and equipment safely, efficiently and effectively</li> <li>• Use information and communication technologies</li> <li>• Perform minor maintenance on equipment</li> <li>• Work with technology safely and according to workplace standards</li> <li>• Use computer-aided design (CAD) technology in the development of designs</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM50311 Diploma of Jewellery and Object Design are:

- completion of all **six (6)** core units of competency
- completion of **twenty (20)** elective units of competency, to bring the total number of units to **twenty six (26)**.

Units with prerequisites are marked with an asterisk. Note that when selecting elective units any prerequisite units must also be completed (refer to units for details).

Elective units of competency must be selected as follows:

- at least **three (3)** units of competency from Group A
- at least **three (3)** units of competency from Group B
- at least **three (3)** units of competency from Group C.

The **eleven (11)** remaining elective units can be selected as follows, to bring the total number of elective units to **twenty (20)**:

- Group A, B or C electives not previously selected
- a maximum of **three (3)** units from Group D
- up to **four (4)** appropriate elective units may be chosen from other endorsed Training Packages and accredited courses where those units are available in a Diploma or Certificate IV qualification.

Appropriate units are those that would be suitable for occupational outcomes in a jewellery and object design environment.

Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

Units that have been achieved through completion of other qualifications will be credited towards the Diploma when they are also included in the unit lists for this qualification.

### CORE UNITS

- Complete all **six (6)** units of competency from this list:

Unit code	Unit title	P
MEM13014A	Apply principles of occupational health and safety in the work environment	
MEM19023A	Apply drawing and rendering techniques to jewellery or object design	
MEM19026A	Investigate quality and application of jewellery materials	
CUVPRP501A	Realise a body of creative work	
CUVRES502A	Analyse cultural history and theory	
MSAENV272B	Participate in environmentally sustainable work practices	

### ELECTIVE UNITS

#### Group A: Specialist jewellery and object creative and design units

- Select a minimum of **three (3)** units of competency from this list:

Unit code	Unit title	P
MEM19024A	Use CAD to create and display 3D jewellery and object models	
MEM19025A	Create and present designs for jewellery and other 3D objects	
MEM19027A	Produce life drawings for presenting jewellery and object	*

Unit code	Unit title	P
	designs	
MEM19028A	Select materials and new technologies for jewellery and 3D object design applications	
MEM19029A	Produce a professional jewellery design and 3D object portfolio	
MEM19030A	Research and design sustainable objects	
MEM19031A	Produce renderings and technical drawings for jewellery and object design construction	

### Group B: Design process and drawing units

- Select a minimum of **three (3)** units of competency from this list:

Unit code	Unit title	P
MEM09002B	Interpret technical drawing	
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
BSBCRT501A	Originate and develop concepts	
BSBDES402A	Interpret and respond to a design brief	
BSBDES502A	Establish, negotiate and refine a design brief	
CUVACD504A	Research and apply light and colour	
CUVACD506A	Refine 2-D design ideas and processes	
CUVACD507A	Refine 3-D design ideas and processes	
CUVDRA501A	Refine drawing techniques	
CUVDRA502A	Investigate drawing materials and processes	
CUVPRP503A	Present a body of own creative work	
LMFFDT4012A	Produce ideation drawings	

### Group C: Jewellery and object production units

- Select a minimum of **three (3)** units from this list:

Unit code	Unit title	P
MEM05006C	Perform brazing and/or silver soldering	
MEM06007B	Perform basic incidental heat/quenching, tempering and	

	annealing	
MEM08010B	Manually finish/polish materials	*
MEM12023A	Perform engineering measurements	
MEM12024A	Perform computations	
MEM13003B	Work safely with industrial chemicals and materials	
MEM13004B	Work safely with molten metals/glass	
MEM18001C	Use hand tools	
MEM18002B	Use power tools/hand held operations	
MEM18003C	Use tools for precision work	*
MEM19001B	Perform jewellery metal casting	*
MEM19012B	Produce jewellery wax model	*
MEM19013B	Produce jewellery metal masters	*
MEM19032A	Design and implement mechanisms in jewellery items	
MEM19033A	Create silversmithing objects	
MEM19034A	Apply chain manufacture process	
MEM19035A	Plan and apply casting techniques for jewellery and object designs	
MEM19036A	Use specialised techniques to produce jewellery and objects	
MEM19037A	Plan and implement chenier fabrication process	
MEM22015A	Source and estimate engineering materials requirements	
CUVACD304A	Make scale models	
CUVDES403A	Research and apply techniques for the design of wearable objects	
CUVJWL401A	Experiment with techniques to produce jewellery	

### Group D: General electives

- Select a maximum of **three (3)** units of competency from this list:

Unit code	Unit title	P
<b>Digital context and imaging</b>		
MEM16008A	Interact with computing technology	
MEM19042A	Render images using computer graphics software	*
CUVACD512A	Work with photomedia in art and design practice	

Unit code	Unit title	P
CUVDIG401A	Experiment with techniques to enhance digital images	
CUVDIG501A	Refine digital art techniques	
CUVGRD301A	Prepare files for publication	
CUVPHI302A	Capture photographic images	
CUVPHI403A	Apply photo imaging lighting techniques	
<b>Communication</b>		
MEM16006A	Organise and communicate information	
BSBCMM401A	Make a presentation	
BSBCRT401A	Articulate, present and debate ideas	
BSBCRT402A	Collaborate in a creative process	
CUVPRP405A	Develop and discuss ideas for own creative work	
<b>Professional practice and management/industry context</b>		
BSBIPR501A	Manage intellectual property to protect and grow business	
BSBIPR401A	Use and respect copyright	
BSBPMG522A	Undertake project work	
BSBSMB403A	Market the small business	
BSBSMB405B	Monitor and manage small business operations	
BSBSMB406A	Manage small business finances	
CUFIND201A	Develop and apply creative arts industry knowledge	
CUFRES401A	Conduct research	
CUVPRP403A	Select and organise finished work for storage	
CUVPRP502A	Prepare for sustainable professional practice	
MSAENV472B	Implement and monitor environmentally sustainable work practices	
SIRXSLS201	Sell products and services	

## Custom Content Section

Not applicable.

## MEM60112 Advanced Diploma of Engineering

### Modification History

Release 2 – Equivalent. ISC code correction in Avionic stream to updated unit MEM23086A.

### Description

Not Applicable

### Pathways Information

Not Applicable

### Licensing/Regulatory Information

There are no specific licences that relate to this qualification. However, for employment at paraprofessional levels in the aeronautical and avionic fields in the Australian aviation industry, the Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA) have requirements that must be met. Units designed to meet these requirements are included as electives in this qualification. Advice on the selection of electives to meet ADF and CASA requirements is given at the end of this qualification.

### Entry Requirements

Not Applicable

### Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"><li>• Read, interpret and follow information on legislative and regulatory requirements, codes of practice, specifications, design briefs, charts, lists, drawings and other applicable reference documents</li><li>• Access, organise and communicate information from reference texts, manufacturer's catalogues and industrial magazines, websites, use of phone, email and fax</li><li>• Negotiate, develop, implement and document work instructions, outcomes and performance measures</li><li>• Communicate complex ideas through presentations, meetings</li></ul>

	<ul style="list-style-type: none"> <li>and one-on-one communication</li> <li>• Prepare reports, graphics, specifications and other documentation</li> <li>• Use standard engineering drawing symbols, references, terminology and scientific notation</li> <li>• Consult and advise internal and external clients to ensure clarification of requirements for projects or operations</li> <li>• Liaise with internal and external stakeholders and others to confirm specifications and discuss alternatives</li> <li>• Research, evaluate and report information on systems, techniques, requirements, options and solutions</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Work alone or as part of single and multi-disciplinary teams that includes other para-professionals, professionals, trades and production personnel</li> <li>• Provide clear and precise information to team members</li> <li>• Negotiate and communicate with stakeholders</li> <li>• Continually monitor and review team performance</li> <li>• Delegate and supervise work where appropriate</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>• Analyse and evaluate information to determine requirements, strategies and solutions (including benefit/cost analysis)</li> <li>• Apply and manipulate mathematical techniques and scientific principles to engineering situations (including arithmetic, algebraic expressions with one independent variable, two-dimensional geometry, trigonometry, linear functions, basic quadratic functions, basic statistical methods, significant figures)</li> <li>• Evaluate and rank engineering options</li> <li>• Evaluate environmental and sustainability performance of equipment and processes and make recommendations for improvements</li> <li>• Perform hazard and risk analysis</li> <li>• Identify and select common engineering materials by their principal properties</li> <li>• Diagnose performance and process problems</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Be capable of applying skills and knowledge in new and different situations and contexts</li> <li>• Use judgement and discretion</li> <li>• Facilitate and capitalise on change and innovation</li> <li>• Generate innovative and creative ideas, approaches and solutions</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Design and plan documentation for particular applications</li> <li>• Plan and sequence work operations</li> <li>• Manage work priorities and resources</li> <li>• Prepare, monitor and review work plans, programs and budgets</li> </ul>



	<ul style="list-style-type: none"> <li>Identify requirements and manage processes to ensure adequate resourcing, programming, maintenance and training for operations</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>Manage own time and own processes</li> <li>Complete tasks in a competent and timely manner</li> <li>Set personal goals and plans</li> <li>Gain and use feedback to improve personal performance</li> <li>Address all legislation, codes and standards related to safety, environmental impact and sustainability issues</li> </ul>
Learning	<ul style="list-style-type: none"> <li>Undertake research by consulting appropriate personnel, technical experts, manuals, online help and other reference materials as required</li> <li>Evaluate career options and develop career path strategy</li> <li>Review and maintain academic development, work experience, ethical practice, indemnity, negotiation, consultation and human relations with respect to the practice of engineering</li> <li>Manage learning opportunities in and outside the workplace</li> <li>Mentor others</li> <li>Identify options for professional development opportunities</li> </ul>
Technology	<ul style="list-style-type: none"> <li>Apply engineering knowledge and principles</li> <li>Select and apply engineering techniques and associated technologies, software and hardware</li> <li>Use technology appropriately to manage work priorities and commitments</li> <li>Use a CAD program, computer and peripherals</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM60112 Advanced Diploma of Engineering are:

- completion of the **seven (7)** core units of competency listed below, and
- completion of **twenty three (23)** elective units, to bring the total number of units to **thirty (30)**.

Group A and Group B elective units must be selected as follows:

- up to **eight (8)** general elective units from the list in Group A
- at least **fifteen (15)** specialist elective units from Group B, to bring the total number of elective units to **twenty three (23)**.

Note that when selecting elective units any prerequisite units must also be completed and count towards the required number of elective units (refer to units for details).

Five (5) appropriate Group B electives may be chosen from other endorsed Training Packages and accredited courses where those units are available for inclusion at Advanced Diploma.

Note that the Group A and B elective units listed below include all the MEM units that are approved for selection in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

### Additional qualification descriptors

The following additional descriptors are approved for use with this qualification:  
Mechanical, Mechatronics, Manufacturing, Maintenance, Aeronautical and Avionics.

### Core units

- Select all of the units from this list.

Unit code	Unit title
MEM16006A	Organise and communicate information
MEM16008A	Interact with computing technology
MEM22001A	Perform engineering activities
MEM22002A	Manage self in the engineering environment
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment
MSAENV272B	Participate in environmentally sustainable work practices

### Elective units

#### Group A - general

- Select up to **eight (8)** units from this list.

Unit code	Unit title	Prerequisites
MEA101B	Interpret occupational health and safety practices in aviation maintenance	
MEA105C	Apply quality standards applicable to aviation maintenance	*

Unit code	Unit title	Prerequisites
	processes	
MEA107B	Interpret and use aviation maintenance industry manuals and specifications	
MEA108B	Complete aviation maintenance industry documentation	*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance	*
MEA270A	Lay out avionic systems	*
MEA271A	Lay out avionic flight management systems	*
MEA340A	Lay out and set up aircraft systems	*
MEA341A	Apply basic aircraft design characteristics	*
MEM12024A	Perform computations	
MEM13013B	Work safely with ionising radiation	
MEM15001B	Perform basic statistical quality control	
MEM18001C	Use hand tools	
MEM24001B	Perform basic penetrant testing	*
MEM24003B	Perform basic magnetic particle testing	*
MEM24005B	Perform basic eddy current testing	*
MEM24007B	Perform ultrasonic thickness testing	*
MEM24009B	Perform basic radiographic testing	*
MEM30005A	Calculate force systems within simple beam structures	*
MEM30006A	Calculate stresses in simple structures	*
MEM30008A	Apply basic economic and ergonomic concepts to evaluate engineering applications	
MEM30009A	Contribute to the design of basic mechanical systems	*
MEM30010A	Set up basic hydraulic circuits	
MEM30011A	Set up basic pneumatic circuits	

Unit code	Unit title	Prerequisites
MEM30013A	Assist in the preparation of a basic workplace layout	
MEM30014A	Apply basic just in time systems to the reduction of waste	
MEM30015A	Develop recommendations for basic set up time improvements	
MEM30016A	Assist in the analysis of a supply chain	
MEM30017A	Use basic preventative maintenance techniques and tools	
MEM30018A	Undertake basic process planning	
MEM30019A	Use resource planning software systems in manufacturing	
MEM30020A	Develop and manage a plan for a simple manufacturing related project	
MEM30021A	Prepare a simple production schedule	
MEM30022A	Undertake supervised procurement activities	
MEM30023A	Prepare a simple cost estimate for a manufactured product	
MEM30024A	Participate in quality assurance techniques	*
MEM30025A	Analyse a simple electrical system circuit	*
MEM30026A	Select and test components for simple electronic switching and timing circuits	*
MEM30027A	Prepare basic programs for programmable logic controllers	
MEM30028A	Assist in sales of technical products/systems	
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
MEM30032A	Produce basic engineering drawings	
MEM30033A	Use computer-aided design (CAD) system to create and display 3-D models	*
MSAENV472B	Implement and monitor environmentally sustainable work practices	
Prerequisites:	Where a unit has prerequisites then those prerequisite units	

Unit code	Unit title	Prerequisites
	can only be used in the count towards the total number of units where they are listed in the table above.	

### Group B - specialist

- Select at least **fifteen (15)** units from this list to bring the total number of elective units to **twenty three (23)**.

Unit code	Unit title	Prerequisites
MEA272B	Apply basic scientific principles and techniques in avionic engineering situations	
MEA273A	Select and test avionic engineering materials	
MEA342A	Apply basic aircraft power plant design characteristics	*
MEA349B	Apply basic scientific principles and techniques in aeronautical engineering situations	
MEA350A	Select and test aeronautical engineering materials	*
MEM09143A	Represent aeronautical engineering designs	*
MEM09144A	Represent avionic engineering designs	*
MEM09153A	Apply computer aided modelling and data management techniques to aeronautical engineering designs	*
MEM09154A	Apply computer aided modelling and data management techniques to avionic engineering designs	*
MEM09155A	Prepare mechanical models for computer-aided engineering (CAE)	*
MEM09156A	Prepare mechatronic models for computer-aided engineering (CAE)	*
MEM09157A	Perform mechanical engineering design drafting	
MEM09158A	Perform mechatronics engineering design drafting	
MEM09204A	Produce basic engineering detail drawings	*
MEM09205A	Produce electrical schematic drawings	*
MEM12005B	Calibrate measuring equipment	*

Unit code	Unit title	Prerequisites
MEM12022B	Program coordinate measuring machine (advanced)	*
MEM12025A	Use graphical techniques and perform simple statistical computations	*
MEM13010A	Supervise occupational health and safety in an industrial work environment	*
MEM14001B	Schedule material deliveries	
MEM14002B	Undertake basic process planning	
MEM14003B	Undertake basic production scheduling	
MEM14065A	Plan and design aeronautical engineering projects	*
MEM14066A	Plan and design avionic engineering projects	*
MEM14083A	Apply aeronautical engineering fundamentals to support design and development of engineering projects	*
MEM14084A	Apply avionic engineering fundamentals to support design and development of engineering projects	*
MEM14085A	Apply mechanical engineering analysis techniques	
MEM14086A	Apply mechatronic engineering analysis techniques	
MEM14087A	Apply manufactured product design techniques	*
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications	*
MEM14089A	Integrate mechanical fundamentals into an engineering task	*
MEM14090A	Integrate mechatronic fundamentals into an engineering task	*
MEM14091A	Integrate manufacturing fundamentals into an engineering task	*
MEM14092A	Integrate maintenance fundamentals into an engineering task	*
MEM15007B	Conduct product and/or process capability studies	*
MEM15008B	Perform advanced statistical quality control	*
MEM15010B	Perform laboratory procedures	

Unit code	Unit title	Prerequisites
MEM15011B	Exercise external quality assurance	*
MEM15012B	Maintain/supervise application of quality procedures	*
MEM18016B	Analyse plant/equipment condition monitoring results	*
MEM22007A	Manage environmental effects of engineering activities	*
MEM22012A	Coordinate resources for an engineering project or operation	
MEM22013A	Coordinate engineering projects	
MEM22014A	Coordinate engineering-related manufacturing operations	*
MEM22015A	Source and estimate engineering materials requirements	
MEM22017A	Coordinate continuous improvement and technical development	
MEM22018A	Coordinate sales and promotion of engineering-related products or services	
MEM23003A	Operate and program computers and/or controllers in engineering situations	*
MEM23004A	Apply technical mathematics	
MEM23005A	Apply statistics and probability techniques to engineering tasks	*
MEM23006A	Apply fluid and thermodynamics principles in engineering	*
MEM23007A	Apply calculus to engineering tasks	*
MEM23008A	Apply advanced algebra and numerical methods to engineering tasks	*
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations	
MEM23063A	Select and test mechanical engineering materials	*
MEM23064A	Select and test mechatronic engineering materials	*
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques	*

Unit code	Unit title	Prerequisites
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques	*
MEM23084A	Apply scientific principles and techniques in aeronautical engineering situations	*
MEM23086A	Apply scientific principles and techniques in avionic engineering situations	*
MEM23095A	Apply aeronautical system design principles and techniques in aeronautical engineering situations	*
MEM23096A	Apply avionic system design principles and techniques in avionic engineering situations	*
MEM23097A	Apply automated systems principles and techniques in aeronautical engineering situations	*
MEM23098A	Apply automated systems principles and techniques in avionic engineering situations	*
MEM23109A	Apply engineering mechanic principles	*
MEM23111A	Select electrical equipment and components for engineering applications	*
MEM23112A	Investigate electric and electronic controllers in engineering applications	*
MEM23113A	Evaluate hydrodynamic systems and system components	*
MEM23114A	Evaluate thermodynamic systems and components	*
MEM23115A	Evaluate fluid power systems	*
MEM23116A	Evaluate programmable logic controller and related control system component applications	*
MEM23117A	Evaluate microcontroller applications	*
MEM23118A	Apply production and service control techniques	*
MEM23119A	Evaluate continuous improvement processes	*
MEM23120A	Select mechanical machine and equipment components	*
MEM23121A	Analyse loads on frames and mechanisms	*



Unit code	Unit title	Prerequisites
MEM23122A	Evaluate computer integrated manufacturing systems	*
MEM23123A	Evaluate manufacturing processes	
MEM23124A	Measure and analyse noise and vibration	*
MEM23125A	Evaluate maintenance systems	*
MEM23126A	Evaluate industrial robotic applications	*
MEM23129A	Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration	*
MEM23130A	Coordinate servicing and fault finding of HVAC/R control systems	*
MEM23131A	Evaluate rapid prototyping applications	*
MEM23132A	Evaluate rapid manufacturing processes	*
MEM23133A	Evaluate rapid tooling applications	*
MEM23134A	Evaluate jigs and fixtures	*
MEM23135A	Evaluate moulding tools and processes	*
MEM23136A	Evaluate stamping and forging tools	*
MEM23137A	Evaluate rolling tools and processes	*
MEM23138A	Evaluate suitability of materials for engineering related applications	*
MEM23141A	Complete a building thermal performance survey	*
MEM23144A	Contribute to the design of a commercial refrigeration system	*
MEM23146A	Contribute to the design of industrial refrigeration systems	*
MEM23147A	Contribute to the design of hydronic systems	*
MEM23149A	Contribute to the design of commercial and industrial exhaust systems	*
MEM23150A	Contribute to the design of heating systems	*

Unit code	Unit title	Prerequisites
MEM23153A	Contribute to the design of heat exchanger systems	*
MEM24002B	Perform penetrant testing	*
MEM24004B	Perform magnetic particle testing	*
MEM24006B	Perform eddy current testing	*
MEM24008B	Perform ultrasonic testing	*
MEM24010B	Perform radiographic testing	*
MEM24011B	Establish non-destructive tests	*
MEM24012C	Apply metallurgy principles	
MEM30029A	Use workshop equipment and processes to complete an engineering project	
MSS402030A	Apply cost factors to work practices	
MSS402060A	Use planning software systems in operations	
MSS402061A	Use SCADA systems in operations	
MSS402080A	Undertake root cause analysis	
MSS403001A	Implement competitive systems and practices	
MSS403002A	Ensure process improvements are sustained	
MSS403010A	Facilitate change in an organisation implementing competitive systems and practices	
MSS403021A	Facilitate a Just in Time system	
MSS403023A	Monitor a levelled pull system of operations	
MSS403030A	Improve cost factors in work practices	
MSS403032A	Analyse manual handling processes	
MSS403040A	Facilitate and improve implementation of 5S	
MSS403051A	Mistake proof an operational process	
MSS404050A	Undertake process capability improvements	*

Unit code	Unit title	Prerequisites
MSS404052A	Apply statistics to operational processes	
MSS404060A	Facilitate the use of planning software systems in a work area or team	
MSS404061A	Facilitate the use of SCADA systems in a team or work area	
MSS404081A	Undertake proactive maintenance analyses	
MSS404082A	Assist in implementing a proactive maintenance strategy	
MSS405001A	Develop competitive systems and practices for an organisation	
MSS405002A	Analyse and map a value stream	
MSS405003A	Manage a value stream	
MSS405004A	Develop business plans in an organisation implementing competitive systems and practices	
MSS405005A	Manage competitive systems and practices in an organisation responding to individual and unique customer orders	
MSS405010A	Manage relationships with non-customer external organisations	
MSS405011A	Manage people relationships	
MSS405012A	Manage workplace learning	
MSS405020A	Develop quick changeover procedures	
MSS405021A	Develop a Just in Time system	
MSS405022A	Design a process layout	
MSS405023A	Develop a levelled pull system for operations and processes	
MSS405030A	Optimise cost of product or service	
MSS405031A	Undertake value analysis of a product or process costs in terms of customer requirements	
MSS405040A	Manage 5S system in an organisation	
MSS405050A	Determine and improve process capability	*

Unit code	Unit title	Prerequisites
MSS405052A	Design an experiment	*
MSS405060A	Develop the application of enterprise control systems in an organisation	
MSS405061A	Determine and establish information collection requirements and processes	
MSS405070A	Develop and manage sustainable energy practices	
MSS405075A	Facilitate the development of a new product	*
MSS405081A	Develop a proactive maintenance strategy	
MSS405083A	Adapt a proactive maintenance strategy for a seasonal or cyclical manufacturing business	
MSAENV672B	Develop workplace policy and procedures for sustainability	
Prerequisites:	Where a unit has prerequisites then those prerequisite units can only be used in the count towards the total number of units where they are listed in the table above.	

In addition to the above, the minimum requirements for this qualification can also be met by holders of the MEM30505 Certificate III in Engineering - Technical or the MEM50212 Diploma of Engineering - Technical or equivalent subject to the completion of the specified Core units of competency as well as the additional elective units drawn from Group B.

### Packaging advice to meet Australian Defence Force (ADF) and the Civil Aviation Safety Authority (CASA) requirements

In order to meet the requirements of both Regulators for employment as paraprofessionals in aeronautical and avionic fields in the Australian aviation industry, electives must be selected as described below for the Aeronautical and Avionic streams.

#### Aeronautical stream

- Select the following **seven (7)** units from Group A

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA105C	Apply quality standards applicable to aviation maintenance processes*
MEA107B	Interpret and use aviation maintenance industry manuals and specifications

MEA108B	Complete aviation maintenance industry documentation*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals*
MEA340A	Lay out and set up aircraft systems*
MEA341A	Apply basic aircraft design characteristics*

- Select the following **twelve (12)** units from Group B

MEA342A	Apply basic aircraft power plant design characteristics*
MEA349B	Apply basic scientific principles and techniques in aeronautical engineering situations
MEA350A	Select and test aeronautical engineering materials*
MEM09143A	Represent aeronautical engineering designs*
MEM09153A	Apply computer aided modelling and data management techniques to aeronautical engineering designs*
MEM14065A	Plan and design aeronautical engineering projects*
MEM14083A	Apply aeronautical fundamentals to support design and development of engineering projects*
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques*
MEM23084A	Apply scientific principles and techniques in aeronautical engineering situations*
MEM23095A	Apply aeronautical system design principles and techniques in aeronautical engineering situations*
MEM23097A	Apply automated systems principles and techniques in aeronautical engineering situations*

To bring the total number of electives to **twenty three (23)**, another four units are to be selected as follows:

- a minimum of **three (3)** additional units must be chosen from Group B
- a maximum of **one (1)** additional unit can be chosen from Group A, or from the Advanced Diploma level units in the MEA11 Aeroskills Training Package.

**Avionic stream**

- Select the following **seven (7)** units from Group A

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA105C	Apply quality standards applicable to aviation maintenance processes*
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA108B	Complete aviation maintenance industry documentation*
MEA109B	Perform basic hand skills, standard trade practices and fundamentals*
MEA270A	Lay out avionic systems*
MEA271A	Lay out avionic flight management systems*

- Select the following **ten (10)** units from Group B

MEA272B	Apply basic scientific principles and techniques in avionic engineering situations
MEA273A	Select and test avionic engineering materials
MEM09144A	Represent avionic engineering designs*
MEM09154A	Apply computer aided modelling and data management techniques to avionic engineering designs*
MEM14066A	Plan and design avionic engineering projects*
MEM14084A	Apply avionic fundamentals to support design and development of engineering projects*
MEM23074A	Select and apply avionic engineering methods, processes and construction techniques*
MEM23086A	Apply scientific principles and techniques in avionic engineering situations*
MEM23096A	Apply avionic system design principles and techniques in avionic engineering situations*
MEM23098A	Apply automated systems principles and techniques in avionic engineering situations*

To bring the total number of electives to **twenty three (23)**, another **six (6)** units are to be selected as follows:

- a minimum of **five (5)** additional units must be chosen from Group B
- a maximum of **one (1)** additional unit can be chosen from Group A, or from Advanced Diploma level units in the MEA11 Aeroskills Training Package.
-

# **MEM60211 Advanced Diploma of Jewellery and Object Design**

## **Modification History**

Release 4 - Imported elective units replaced by current versions.

Release 3 - Elective unit MEM22006A replaced by MEM22015A in Group D.

Release 2 - Elective unit MEM30001A replaced by MEM30031A

Release 1 - New qualification

## **Description**

This qualification describes the skills and knowledge required to develop jewellery and object design solutions that require a wide range of specialised technical and creative skills. Design solutions reflect consideration of aesthetics, function, production techniques, material characteristics, and marketability of jewellery and objects.

### **Job roles/employment outcomes**

This qualification targets independent professional designers or designers/practitioners in jewellery and objects. Designs may meet a specific client brief and reflect original design concepts. This person is likely to be an owner/operator or employed in a production workshop or small business operation and working directly with clients to produce items.

### **Application**

This qualification is typically used to develop skills and knowledge in jewellery and object design enterprises. Skills gained from this qualification may be applied to specialist jewellery and object design briefs, including heritage jewellery, theatre and film commissions, exhibitions and churchware, as well as one-off individual client briefs.

## **Pathways Information**

### **Pathways into the qualification**

This qualification may be accessed by direct entry. Credit will be granted towards this qualification to those who have completed MEM50311 Diploma of Jewellery and Object Design, MEM40311 Certificate IV in Advanced Jewellery Manufacture (under development), or who can demonstrate equivalent vocational experience.

### **Pathways from the qualification**

Further training pathways from this qualification include appropriate higher education or Vocational Graduate qualifications.



## Licensing/Regulatory Information

There is no direct link between this qualification and licensing, legislative and/or regulatory requirements. However, all work must comply with occupational health and safety (OHS) and environmental regulations and legislation that apply to the workplace.

## Entry Requirements

Not applicable.

## Employability Skills Summary

### Advanced Diploma of Jewellery and object design

The following table contains a summary of the employability skills as identified by the jewellery and object design industry for this qualification. This table should be interpreted in conjunction with the detailed requirements of each unit of competency packaged in this qualification. The outcomes described here are broad industry requirements that reflect skill requirements for this level.

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>• Use research and communication techniques and technology to gather and interpret data and information related to the development designs</li> <li>• Develop design specifications in consultation with client</li> <li>• Make calculations to determine production specifications</li> <li>• Communicate with clients and design or production team</li> <li>• Complete design documentation in a range of formats including drawings, specifications and plans</li> <li>• Produce detailed specifications and production documents to guide production</li> <li>• Negotiate designs with clients</li> <li>• Present design ideas</li> <li>• Interact with and negotiate with industry representatives</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>• Demonstrate and encourage others in working cooperatively with people of different ages, gender, race or religion</li> <li>• Provide and obtain feedback on processes, outcomes and specifications to support and improve team outcomes</li> <li>• Exchange information with clients and design team</li> <li>• Provide support to production team and oversee outcomes</li> </ul>

	<ul style="list-style-type: none"> <li>• Work with others throughout the design and production process</li> <li>• Provide leadership and direction to others</li> <li>• Participate in sustainability improvement</li> </ul>
Problem solving	<ul style="list-style-type: none"> <li>• Analyse suitability of materials for design concept</li> <li>• Analyse and apply design influences to determine trends and opportunities</li> <li>• Evaluate information to guide design development and processes</li> <li>• Make modifications to designs or techniques based on client requirements, production or resource issues</li> <li>• Identify and address design and production problems</li> <li>• Determine and test specifications to meet objectives</li> <li>• Assess commercial viability of designs</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>• Test procedures and design concepts to assess effectiveness in meeting objectives</li> <li>• Provide leadership in design and production processes</li> <li>• Identify non-conformances to standards and initiate appropriate action</li> <li>• Identify and implement effective ways to achieve design and production outcomes</li> <li>• Initiate and implement continuous improvement practices</li> <li>• Develop new designs for a target market</li> <li>• Identify design opportunities</li> <li>• Sell ideas to clients and other stakeholders</li> <li>• Determine promotional opportunities for work</li> <li>• Explore creative possibilities for designs</li> <li>• Evaluate sustainability of operations</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>• Evaluate quality outcomes</li> <li>• Determine production requirements and plans for designs</li> <li>• Develop design and production plans</li> <li>• Plan processes to achieve desired outcomes within agreed timeframes</li> <li>• Ensure workplace and equipment are set up so that work requirements are met</li> <li>• Manage design and production processes</li> <li>• Produce and test design prototypes</li> <li>• Develop and implement contingency plans when responding to incidents and problems</li> <li>• Identify and monitor resource use in own work</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Monitor own work against workplace, industry and quality standards</li> <li>• Adjust processes or techniques as required according to variations in requirements</li> <li>• Implement and apply OHS practices in the workplace</li> </ul>

	<ul style="list-style-type: none"> <li>• Seek feedback on own work to assess areas for improvement</li> <li>• Test quality and viability of work</li> <li>• Conduct work in a manner which minimises waste</li> <li>• Maintain currency of knowledge of trends, techniques and influences</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Assess own skill requirements and seek further development if required</li> <li>• Develop or adjust processes based on new information</li> <li>• Maintain current knowledge and skills in trends, techniques and influences</li> <li>• Seek feedback from target market on designs and products</li> <li>• Use design tools to explore and test design concepts</li> <li>• Experiment with materials, design concepts and production techniques</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Use information and communication technology to acquire, manage and share information</li> <li>• Use computer aided design (CAD) technology in the development of designs</li> <li>• Use machinery and equipment in the production of prototypes</li> </ul>

## Packaging Rules

The minimum requirements for achievement of the MEM60211 Advanced Diploma of Jewellery and Object Design are:

- completion of all **nine (9)** core units of competency
- completion of **twenty seven (27)** elective units of competency, to bring the total number of units to **thirty six (36)**.

Units with prerequisites are marked with an asterisk. Note that when selecting elective units any prerequisite units must also be completed (refer to units for details).

Elective units of competency must be selected as follows:

- at least **five (5)** units of competency from Group A
- at least **three (3)** units of competency from Group B
- at least **three (3)** units of competency from Group C
- at least **three (3)** units of competency from Group D.

The **thirteen (13)** remaining elective units can be selected as follows, to bring the total number of elective units to **twenty seven (27)**:

- Group A, B, C or D electives not previously selected
- a maximum of **five (5)** units from Group E
- up to **six (6)** appropriate elective units may be chosen from other endorsed Training Packages and accredited courses where those units are available in an Advanced Diploma, Diploma (maximum 4 units) or Certificate IV (maximum 4 units) qualification.

Appropriate units are those that would be suitable for occupational outcomes in a jewellery and object design environment.

Note that the elective units listed below include all of the units that are approved for selection from the MEM05 Training Package for use in this qualification. This meets the NSSC requirement that one sixth of the total units must be able to be selected from other qualifications in the same Training Package.

## CORE UNITS

- Complete all **nine (9)** units of competency from this list:

Unit code	Unit title	P
MEM13014A	Apply principles of occupational health and safety in the work environment	
MEM19023A	Apply drawing and rendering techniques to jewellery or object design	
MEM19026A	Investigate quality and application of jewellery materials	
MEM19040A	Create and manufacture jewellery or object design prototypes for the mass market	
MEM19041A	Experiment with jewellery or object designs	
BSBDES502A	Establish, negotiate and refine a design brief	
CUVPRP501A	Realise a body of creative work	
CUVRES502A	Analyse cultural history and theory	
MSAENV272B	Participate in environmentally sustainable work practices	

## ELECTIVE UNITS

### Group A: Specialist Advanced Diploma jewellery and object design units

- Select a minimum of **five (5)** units of competency from this list:

Unit code	Unit title	P
MEM19038A	Apply traditional techniques to jewellery and 3D object production	
MEM19039A	Plan, conduct and supervise a jewellery and object exhibition	
MEM19043A	Oversee jewellery or object design production	
BSBCRT601A	Research and apply concepts and theories of creativity	
BSBDES601A	Manage design realisation	
BSBDES602A	Research global design trends	
BSBDES701A	Research and apply design theory	
CUVACD601A	Extend professional expertise with drawing and other visual representation tools	
CUVPRP601A	Originate a body of independent creative work	
CUVPRP602A	Collaborate in professional creative projects	
CUVPRP603A	Engage in the business of creative practice	
CUVPRP604A	Publicly present a body of own creative work	
CUVRES601A	Extend cultural research expertise	

### Group B: Specialist jewellery and object creative and design units

- Select a minimum of **three (3)** units of competency from this list:

Unit code	Unit title	P
MEM19024A	Use CAD to create and display 3D jewellery and object models	
MEM19025A	Create and present designs for jewellery and other 3D objects	
MEM19027A	Produce life drawings for presenting jewellery and object designs	*
MEM19028A	Select materials and new technologies for jewellery and 3D object design applications	

Unit code	Unit title	P
MEM19029A	Produce a professional jewellery design and 3D object portfolio	
MEM19030A	Research and design sustainable objects	
MEM19031A	Produce renderings and technical drawings for jewellery and object design construction	

### Group C: Design process and drawing units

- Select a minimum of **three (3)** units of competency from this list:

Unit code	Unit title	P
MEM09002B	Interpret technical drawing	
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements	
BSBCRT501A	Originate and develop concepts	
BSBDES402A	Interpret and respond to a design brief	
CUVACD504A	Research and apply light and colour	
CUVACD506A	Refine 2-D design ideas and processes	
CUVACD507A	Refine 3-D design ideas and processes	
CUVDRA502A	Investigate drawing materials and processes	
CUVDRA501A	Refine drawing techniques	
CUVPRP503A	Present a body of own creative work	
LMFFDT4012A	Produce ideation drawings	

### Group D: Jewellery and object production units

- Select a minimum of **three (3)** units of competency from this list:

Unit code	Unit title	P
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MEM05006C	Perform brazing and/or silver soldering	
MEM06007B	Perform basic incidental heat/quenching, tempering and annealing	
MEM08010B	Manually finish/polish materials	*
MEM12023A	Perform engineering measurements	
MEM12024A	Perform computations	
MEM13003B	Work safely with industrial chemicals and materials	
MEM13004B	Work safely with molten metals/glass	
MEM18001C	Use hand tools	
MEM18002B	Use power tools/hand held operations	
MEM18003C	Use tools for precision work	*
MEM19001B	Perform jewellery metal casting	*
MEM19012B	Produce jewellery wax model	*
MEM19013B	Produce jewellery metal masters	*
MEM19032A	Design and implement mechanisms in jewellery items	
MEM19033A	Create silversmithing objects	
MEM19034A	Apply chain manufacture process	
MEM19035A	Plan and apply casting techniques for jewellery and object designs	
MEM19036A	Use specialised techniques to produce jewellery and objects	
MEM19037A	Plan and implement chainier fabrication process	
MEM22015A	Source and estimate engineering materials requirements	
CUVACD304A	Make scale models	
CUVDES403A	Research and apply techniques for the design of wearable objects	
CUVJWL401A	Experiment with techniques to produce jewellery	

### Group E: General Electives

- A maximum of **five (5)** units may be selected from the following list:

Unit code	Unit title	P
<b>Digital context and imaging</b>		
MEM16008A	Interact with computing technology	
MEM19042A	Render images using computer graphics software	*
CUVACD512A	Work with photomedia in creative practice	
CUVDIG401A	Experiment with techniques to enhance digital images	
CUVDIG501A	Refine digital art techniques	
CUVGRD301A	Prepare files for publication	
CUVPHI302A	Capture photographic images	
CUVPHI403A	Apply photo imaging lighting techniques	
<b>Communication</b>		
MEM16006A	Organise and communicate information	
BSBCMM401A	Make a presentation	
BSBCRT401A	Articulate, present and debate ideas	
BSBCRT402A	Collaborate in a creative process	
CUVPRP405A	Develop and discuss ideas for own creative work	
<b>Professional practice and management/industry context</b>		
BSBIPR401A	Use and respect copyright	
BSBIPR501A	Manage intellectual property to protect and grow business	
BSBPMG522A	Undertake project work	
BSBSMB403A	Market the small business	
BSBSMB405B	Monitor and manage small business operations	
BSBSMB406A	Manage small business finances	
CUFIND201A	Develop and apply creative arts industry knowledge	



Unit code	Unit title	P
CUFRES401A	Conduct research	
CUVPRP403A	Select and organise finished work for storage	
CUVPRP502A	Prepare for sustainable professional practice	
MSAENV472B	Implement and monitor environmentally sustainable work practices	
SIRXSLS201	Sell products and services	

## Custom Content Section

Not applicable.

# **MEM80112 Vocational Graduate Diploma of Engineering**

## **Modification History**

Release 1 – This qualification supersedes MEM80111. Additional elective units included. Competitive manufacturing (MSACM) units replaced by Competitive Systems and Practices units.

## **Description**

The MEM80112 Vocational Graduate Diploma of Engineering is a qualification for people with responsibility and accountability for engineering-related design and/or development, leadership or operations across a range of industries and disciplines. The work environment may be project based or relate to an ongoing senior paraprofessional role as a technical specialist or technical leader.

The MEM80112 Vocational Graduate Diploma of Engineering is designed to build upon existing expertise and provides high level specialist engineering design and engineering technical and project management skills.

The MEM80112 Vocational Graduate Diploma of Engineering can also provide an articulation pathway to professional qualifications.

## **Job roles/employment outcomes**

The MEM80112 Vocational Graduate Diploma of Engineering provides the skills and knowledge for people performing the role of a Principal Technical Officer or equivalent in a range of engineering disciplines. Job roles related to this qualification may include engineering leadership roles, project planning, product development, research and development, project management, operations management, engineering related design and other engineering related technical roles requiring the exercising of engineering related skills of a complex and sophisticated nature or skills in a particular field of technical work.

The MEM80112 Vocational Graduate Diploma of Engineering qualification satisfies the requirements for employment as a Principal Technical Officer under relevant Awards and Agreements. Individuals seeking further information on the relationship of this qualification to the Principal Technical Officer classification should seek advice from their relevant industrial organisation.

## **Pathways Information**

### **Pathways into the qualification**

Pathways for candidates considering this qualification may include:

- a Diploma or Advanced Diploma of Engineering from the MEM05 Metal and Engineering Training Package
- significant relevant vocational training and/or work experience.

### **Pathways from the qualification**

After achieving this qualification, candidates may undertake a Bachelor of Engineering or other suitable higher education qualifications.

### **Additional qualification advice**

Units of competency selected from other Training Packages must be relevant to the work outcome, local industry requirements and the qualification level.

Many units of competency in this qualification assume a level of English, mathematics and science equivalent to a school sector Year 12 standard.

**Note:** Manufacturing Skills Australia recommends that the design of any training delivery and assessment program to support the achievement of this qualification is based on the context required by the industry and/or enterprise.

## **Licensing/Regulatory Information**

There is no direct link between this qualification and licensing, legislative and/or regulatory requirements.

## **Entry Requirements**

Entry requirements for the MEM80112 Vocational Graduate Diploma of Engineering are:

- an Advanced Diploma of Engineering or a Diploma of Engineering, or a
- relevant Certificate IV or Certificate III together with significant relevant vocational practice in an engineering related role, or a
- Bachelor Degree; or other higher education qualification, with relevant vocational practice in an engineering related role.
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## Employability Skills Summary

Employability Skill	Industry/enterprise requirements for this qualification include:
Communication	<ul style="list-style-type: none"> <li>Establish parameters to the brief or contract and provide initial advice</li> <li>Communicate and negotiate with project stakeholders and contributors</li> <li>Communicate with support professionals and technicians</li> <li>Establish visual performance indicators</li> <li>Motivate personnel</li> <li>Review proposal with client to improve outcomes and overcome possible problems</li> <li>Negotiate adjustments to brief or contract</li> <li>Obtain sign-off</li> </ul>
Teamwork	<ul style="list-style-type: none"> <li>Coordinate the work of others, general and specialist, for projects that require complex and specialised knowledge to achieve objectives</li> <li>Research and respond to organisational behaviour and management theory</li> <li>Maintain a database of professional, trades and industry contacts</li> <li>Establish and maintain continuous improvement teams</li> </ul>
Problem-solving	<ul style="list-style-type: none"> <li>Generate and evaluate complex ideas through the analysis of information and concepts at an abstract level</li> <li>Develop continuous improvement processes</li> <li>Implement problem solving and decision making tools, including root cause analysis and solution evaluation techniques</li> </ul>
Initiative and enterprise	<ul style="list-style-type: none"> <li>Initiate, analyse, design, plan, execute and evaluate major functions either broad and/or highly specialised within highly varied and/or highly specialised contexts</li> <li>Generate a range of solutions using appropriate innovation, creativeness and conceptual skills</li> <li>Establish and maintain project or operations management systems</li> </ul>
Planning and organising	<ul style="list-style-type: none"> <li>Optimise the implementation plan and schedule</li> <li>Establish the budget and control measures for project or operations management to conform to the financial business plan</li> <li>Establish physical resources requirements</li> <li>Establish human resources and skills development requirements</li> <li>Establish and maintain records of operations or project for</li> </ul>

	<p>accountability against project objectives, schedule and budget</p> <ul style="list-style-type: none"> <li>• Maintain a plan and schedule of priorities for project or operations activities</li> <li>• Establish and maintain records of legislative compliance</li> <li>• Coordinate project functions, including planning, budgeting and strategy</li> </ul>
Self-management	<ul style="list-style-type: none"> <li>• Demonstrate full responsibility and accountability for personal outputs</li> <li>• Establish personal responsibilities for significant operations or projects</li> <li>• Establish, maintain and perform personal priorities</li> <li>• Establish and pursue a personal professional development program</li> </ul>
Learning	<ul style="list-style-type: none"> <li>• Demonstrate the self-directed development and achievement of broad and/or highly specialised areas of knowledge and skills building on prior knowledge and skills</li> <li>• Establish human resources and skills development requirements</li> <li>• Research and respond to organisational behaviour and management theory</li> <li>• Research industrial and related law</li> <li>• Research financial management techniques</li> <li>• Research knowledge, skills and techniques appropriate to chosen technical electives, mechanical, fluid power, hydrodynamic, thermodynamic, electrical, PLC and microcontroller techniques, computer simulation, differential equations, machine design, noise and vibration, manufacturing and maintenance management techniques</li> </ul>
Technology	<ul style="list-style-type: none"> <li>• Demonstrate an expert command of wide-ranging, highly specialised, technical, creative or conceptual skills in complex and/or highly specialised or varied contexts</li> <li>• Develop knowledge, skills and techniques appropriate to chosen technical electives, mechanical, fluid power, hydrodynamic, thermodynamic, electrical, PLC and microcontroller techniques, computer simulation, differential equations, machine design, noise and vibration, manufacturing and maintenance management techniques</li> <li>• Calibrate equipment, take measurements and analyse results</li> <li>• Use software for modelling, human machine interfaces, graphical user interfaces, and networks for data handling and control</li> </ul>

## Packaging Rules

The MEM80112 Vocational Graduate Diploma of Engineering requires achievement of **ten (10)** units in accordance with the following rules:

- **three (3)** core units of competency
- **seven (7)** elective units of competency.

Elective selection must include:

- a minimum of four (4) Group A elective units
- three (3) remaining elective units may be selected from any combination of:
  - Group A elective units
  - Group B elective units
  - units from any nationally endorsed Training Packages and accredited courses that are packaged at a Vocational Graduate Certificate or Vocational Graduate Diploma level.

**NOTE:** Units marked with an asterisk (\*) have prerequisite unit/s which must be completed either before or concurrently with the listed unit.

### Core units of competency

- Complete the following **three (3)** units of competency.

Unit code	Unit title
MEM234002A	Integrate engineering technologies
MEM234035A	Maintain and apply technical and engineering skills
MSAENV672B	Develop workplace policy and procedures for environmental sustainability

### Elective units of competency

#### Group A

Select a minimum of **four (4)** elective units of competency from the following list.

Unit code	Unit title
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MEM234001A	Plan and manage engineering-related projects or operations
MEM234003A	Design machines and ancillary equipment
MEM234004A	Design for engineering-related noise and vibration mitigation
MEM234005A	Design hydrodynamic pumping systems
MEM234006A	Evaluate and select thermodynamic systems or sub-systems
MEM234007A	Design fluid power systems
MEM234008A	Design plant using computer simulations
MEM234009A	Design computer-integrated manufacturing systems
MEM234010A	Design microcontroller applications
MEM234011A	Design programmable logic controller applications
MEM234012A	Design integrated maintenance management systems
MEM234013A	Plan and design engineering-related manufacturing processes
MEM234014A	Design a robotic system
MEM234015A	Design hydronic heat exchanger systems
MEM234016A	Design refrigeration systems
MEM234017A	Design exhaust, ventilation and dust collection systems
MEM234018A	Design heating, ventilation, air conditioning and refrigeration control systems
MEM234019A	Apply finite element analysis in engineering design
MEM234020A	Coordinate small lot manufacture using rapid manufacture processes
MEM234021A	Apply statistics to technology problems
MEM234022A	Apply advanced calculus to technology problems
MEM234023A	Apply differential equations to technology problems
MEM234024A	Apply advanced mathematics in technology problems
MEM234025A	Apply numerical methods to technology problems

MEM234026A	Develop and coordinate engineering-related contingency plans
MEM234027A	Plan and manage materials supply for an engineering project or manufacturing operation
MEM234028A	Produce and manage technical documentation
MEM234029A	Produce and manage technical publications
MEM234030A	Provide specialised technical and engineering guidance to other technical employees
MEM234031A	Manage installation, commissioning or modification of machines and equipment
MEM234032A	Manage fluid power related technologies in an enterprise
MEM234033A	Lead engineering-related quality operations in an enterprise
MEM234034A	Manage heating, ventilation, air conditioning and refrigeration systems or projects
MSS407012A	Lead a problem solving process to determine and solve root cause
MSL976003A	Evaluate and select appropriate test methods and/or procedures

## Group B

A maximum of three (3) elective units of competency may be selected from the following list, Group A units not already chosen or units from other endorsed Training Packages where the units are available in a Vocational Graduate Certificate or Vocational Graduate Diploma.

Unit code	Unit title
MEM23063A	Select and test mechanical engineering materials*
MEM23064A	Select and test mechatronic engineering materials*
MEM23111A	Select electrical equipment and components for engineering applications*
MEM23112A	Investigate electric and electronic controllers in engineering applications*



MEM23113A	Evaluate hydrodynamic systems and system components*
MEM23114A	Evaluate thermodynamic systems and components*
MEM23115A	Evaluate fluid power systems*
MEM23116A	Evaluate programmable logic controller and related control system component applications*
MEM23117A	Evaluate microcontroller applications*
MEM23118A	Apply production and service control techniques*
MEM23119A	Evaluate continuous improvement processes*
MEM23120A	Select mechanical machine and equipment components*
MEM23121A	Analyse loads on frames and mechanisms*
MEM23122A	Evaluate computer integrated manufacturing systems*
MEM23123A	Evaluate manufacturing processes
MEM23124A	Measure and analyse noise and vibration*
MEM23125A	Evaluate maintenance systems*
MEM234036A	Apply configuration management procedures in engineering management*
MEM234037A	Perform maintenance-related integrated logistic support management activities*
MEM234038A	Apply systems engineering procedures to engineering design project management
BSBLED705A	Plan and implement a mentoring program
BSBLED706A	Plan and implement a coaching strategy
BSBLED710A	Develop human capital
BSBREL701A	Develop and cultivate collaborative partnerships and relationships
MSS407013A	Review continuous improvement processes
MSS407001A	Prepare for and implement change
MSS407002A	Review operations practice tools and techniques

MSS407003A	Analyse process changes
MSS407004A	Facilitate improvements in the internal value stream
MSS407005A	Undertake a qualitative review of a process change
MSS407006A	Build relationships between teams in an operations environment
MSS407007A	Respond to a major non-conformance
MSS407008A	Capture learning from daily activities in a organisation
MSS407009A	Facilitate improvements in the external value stream
MSS407010A	Improve visual management in the workplace
MSS407011A	Manage benchmarking studies
MSS408008A	Analyse data for relevance to organisational learning
MSS408001A	Develop the competitive systems and practices approach
MSS408002A	Audit the use of competitive tools
MSS408003A	Develop models of future state operations practice
MSS408004A	Develop the value stream
MSS408005A	Develop the learning processes of the operations organisation
MSS408006A	Develop and refine systems for continuous improvement in operations
MSS408007A	Develop problem solving capability of an organisation
MSS405007A	Introduce competitive systems and practices to a small or medium enterprise
MSS405020A	Develop quick changeover procedures
MSS405022A	Design a process layout
MSS405023A	Develop a levelled pull system for operations and processes
MSS405032A	Analyse cost implications of maintenance strategy

## Custom Content Section

Not applicable.

# MEMSS00001 Non Destructive Testing - Level 2 NDT practitioner

## Modification History

New Skill Set. Release 1

## Description

This Skill Set is intended to build on existing trade or technical qualifications. The competencies can also provide credit towards higher level qualifications within the Metal and Engineering Training Package. It covers the skill and knowledge requirements that may lead to certification against AS 3998/ISO 9712 - LEVEL 2 in the following methods:

- penetrant testing
- eddy current testing
- ultrasonic testing
- radiographic testing

However, the certifying body may impose additional requirements before a NDT practitioner can work in the field. Applicants should check full certification requirements with the relevant body. Entrants to this Skill Set should have sufficient workplace skills in OH&S, communication and teamwork that provide underpinning competency to acquire and apply the Skill Set.

An individual certified to NDT level 2 is qualified to perform and direct non-destructive testing in accordance with established or recognized procedures. This may include:

- defining the limitations of application of the test method for which the level 2 individual is qualified;
- translating NDT codes, standards, specifications and procedures into practical testing instructions adapted to the actual working conditions;
- setting up and verifying equipment settings;
- performing and supervising tests;
- interpreting and evaluating results according to applicable codes, standards and specifications;
- preparing NDT instructions;
- carrying out or supervising all level 1 duties;
- training or guiding personnel below level 2; and
- organizing and reporting results of non-destructive tests.
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## Pathways Information

Not applicable.

## Licensing/Regulatory Information

Not applicable.

## Skill Set Requirements

MEM18001C	Use hand tools
MEM24002B	Perform penetrant testing
MEM24006B	Perform eddy current testing
MEM24008B	Perform ultrasonic testing
MEM13013B	Work safely with ionizing radiation
MEM24010B	Perform radiographic testing
MEM24012C	Apply metallurgy principles

## Target Group

This Skill Set is appropriate for experienced trade and technical personnel such as NDT technicians, quality assurance inspectors and other operators required to conduct non destructive testing of materials and components using a range of test methods.

The roles, training and experience requirements for NDT operators are defined through a comprehensive range of national and international standards which identify a three level structure. Certification is for a limited period, five years initially, and must be renewed, either on the basis of continuing work experience in the appropriate area or examination. After ten years re-certification is based on examination.

## Suggested words for Statement of Attainment

These competencies are taken from the Metal and Engineering Training Package and provide training that may meet the minimum skill and knowledge requirements for industry certification as a Level 2 NDT practitioner.

## Custom Content Section

Not applicable.

## MEM03001B Perform manual production assembly

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assembling components and/or sub-assemblies in a production environment and testing the components and/or sub-assemblies to ensure compliance with specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to production-orientated assembly operations that are essentially manual in nature and do not require complex adjustments.</p> <p>This unit should not be selected when Unit MEM18055B (Dismantle, replace and assemble engineering components) has already been selected.</p> <p>Where the selection and use of tools is required as part of the assembly process, see Unit MEM18001C (Use hand tools) and Unit MEM18002B (Use power tools/hand held operations) as appropriate.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Read and understand job sheets	1.1.Job sheets and instructions are understood and followed correctly.
2. Select assembly equipment and components	2.1.Assembly equipment is selected according to instructions or job sheets and used to standard operating procedures. 2.2.Components/sub-assemblies are obtained and arranged for assembly. 2.3.Equipment/tools are used in a safe manner.
3. Assemble components	3.1.Assembly is produced following correct sequence of operations, using selected equipment to standard operating procedures. 3.2.Production data is recorded/input to standard



ELEMENT	PERFORMANCE CRITERIA
	operating procedures.
4. Perform tests	4.1.Assembly is tested/checked for compliance to job sheet requirements, following standard operating procedures as required.
5. Protect assembly from damage	5.1.Components and/or assemblies are handled and stored safely, in a manner least likely to cause damage.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- following job instructions and standard operating procedures
- selecting and using assembly tools, components and sub-assemblies
- entering routine and familiar information onto proformas and other standard workplace forms
- following oral instruction

#### Required knowledge

Look for evidence that confirms knowledge of:

- application and use of assembly tools and equipment
- sequence in which the assemblies are to be performed
- storage location of the component/sub-assemblies
- required tests and checks
- required action for non-conformance
- potential damage through the use of inappropriate handling and/or unsafe storage procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with manual production assembly

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to assemble components and/or sub-assemblies in a production environment and test the components and/or sub-assemblies to ensure compliance with specifications.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing manual production assembly or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Components/sub-assemblies**

Parts that make up the sub-assembly and components

**Recorded/input**

By means of production schedules, job sheets, checklists

**Tested/checked**

Carried out according to specification of assembled product

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Assembly
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## MEM03002B Perform precision assembly

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assembling and testing complex engineering components and mechanical assemblies in a production, manufacturing environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to assembly operations that are essentially manual in nature and require the application of accepted engineering principles and practices. Assembly activities typically involve build-to-order work and/or low volume and/or complex assemblies and/or long assembly time frames. This is a production-oriented competency. Work may involve manual adjustments to achieve correct specification.</p> <p>Where varying levels of measurement competencies are required, refer to Units MEM12023A (Perform engineering measurements).</p> <p>This unit should not be selected when Unit MEM18055B (Dismantle, replace and assemble engineering components) has also been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Read and understand job sheets	1.1. Job sheet or equivalent instructions are interpreted correctly. 1.2. All components/sub-assemblies are checked against job sheet, assembly list or equivalent instructions. 1.3. Fitting requirements and sequential assembly planning are carried out where applicable.
2. Select and use assembly tools and equipment	2.1. Tools, equipment and components/sub-assemblies are selected to meet job requirements.
3. Assemble engineering components	3.1. Defective or faulty components/sub-assemblies are identified and processed according to standard operating procedure. 3.2. Components/sub-assemblies are correctly prepared

ELEMENT	PERFORMANCE CRITERIA
	<p>for assembly.</p> <p>3.3. Techniques and principles appropriate to the job requirements are applied in assembly activity.</p> <p>3.4. Records/inputs are accurately maintained or processed.</p> <p>3.5. Components of assembly are fitted to ensure correct positioning and conformance with specifications.</p> <p>3.6. Assembly is tested to ensure that components interface/interact according to operational specifications.</p>
4. Adjust mechanical assemblies	<p>4.1. Final adjustments are performed on assembly to ensure alignment with operational specifications.</p> <p>4.2. Faulty assemblies are identified for rework by operator or, where the fault is outside the scope of the workstation, processed according to standard operating procedure.</p> <p>4.3. The assembly is correctly marked/tagged/identified.</p>
5. Protect assembly from damage	<p>5.1. Components and/or assembly are handled and stored according to standard operating procedures and in a manner least likely to cause damage.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. This may include drawings
- preparing a sequential assembly plan
- selecting and sourcing appropriate tools, components and sub-assemblies
- using tools appropriately
- following job instructions
- identifying faulty components
- following oral instruction
- entering routine and familiar information onto proformas and standard workplace

**REQUIRED SKILLS AND KNOWLEDGE**

forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- fitting requirements
- uses of relevant tools and equipment
- sequence in which the tasks are to be performed
- sources of the component/sub-assemblies
- required action for tests and checks
- required action for non-conformance
- damage to components and/or assemblies through the use of inappropriate handling and/or unsafe storage procedures
- relevant record keeping requirements
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with precision assembly

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assemble and test complex engineering components and mechanical assemblies. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not



**EVIDENCE GUIDE**

	<p>in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with precision assembly or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Components/sub-assemblies**

Includes parts that make up the sub-assembly and components

<b>RANGE STATEMENT</b>	
<b>Technique</b>	Assembly methods and correct use of hand tools
<b>Records/inputs</b>	Production schedules, job sheets, checklists
<b>Tested</b>	Tests and checks to specification of assembled product
<b>Adjustments</b>	Clearances, mesh, tension, level, alignment etc. using predetermined standards of quality and safety

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Assembly
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## MEM03003B Perform sheet and plate assembly

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers assembling prefabricated/formed components using a range of joining techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to production assembly of pre-fabricated/formed components. Applications of this unit may include manufacture of white goods, appliances, electrical cabinets, metal furniture, cladding and shelving, box trailer bodies, ductwork and other sheet and plate assemblies.</p> <p>Where production welding skills are required, refer to Unit MEM05013C (Perform manual production welding).</p> <p>Where soft soldering is required, Unit MEM05003B (Perform soft soldering) should be selected. Where brazing and/or silver soldering is required, Unit MEM05006B (Perform brazing and/or silver soldering) should be selected.</p> <p>Where measurement skills are required, refer to Unit MEM12023A (Perform engineering measurements).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Read and understand job sheets	1.1.Job sheets/instruction are correctly interpreted and followed.
2. Select and use sheet and plate assembly equipment	2.1.Assembly equipment is selected in accordance with instructions on job sheet. 2.2.Equipment is used in a safe manner according to standard operating procedures.
3. Assemble fabrications	3.1.Products to be assembled are verified against specifications. 3.2.Assembly is produced following correct sequence of operations. 3.3.Assemblies/fabrications are joined to specification

ELEMENT	PERFORMANCE CRITERIA
	<p>using specified joining techniques.</p> <p>3.4.Assembly is tested/checked for compliance with job requirements using standard operating procedures.</p>
4. Protect assembly from damage	4.1.Assemblies/fabrications are handled and stored according to standard operating procedures and in a safe manner least likely to cause damage.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following written job sheets, instructions, standard operating procedures and other applicable reference documents
- checking and clarifying routine familiar information
- selecting and using specified assembly equipment and tools
- following sequence of operations
- joining the components/fabrications correctly and safely using appropriate techniques
- testing and checking assembled products for compliance with specifications
- handling and storing components, fabrications and/or assemblies
- checking for conformance to specifications
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- the importance of following the sequence of operations
- application and function of assembly equipment
- safety precautions and operating characteristics of assembly equipment and tools
- application and limitations of different joining techniques
- surface preparation and joining techniques
- assembly tests/checks
- safe handling and storage procedures applicable to components, fabrications and/or assemblies

**REQUIRED SKILLS AND KNOWLEDGE**

- effects of inappropriate handling and storage procedures
- hazards and control measures associated with sheet and plate assembly
- use and application of personal protective equipment
- safe work practices and procedures for sheet and plate assembly

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assemble prefabricated/formed components using a variety of joining techniques. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge,s and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with sheet and plate assembly or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Assembly equipment</b>	Jigs, fixtures and other appropriate tools
<b>Joining techniques</b>	Seaming, bonding, riveting, welding etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Assembly
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## MEM03004B Perform electronic/electrical assembly (production)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying and assembling electronic/electrical components and testing assembled components for conformance to job sheets/specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to assembly of electronic/electrical components or equipment to predetermined specifications and following predetermined procedures.</p> <p>This unit covers the use of automatic wave soldering machines.</p> <p>If soldering skills are required, then Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components) or Unit MEM05002B (Perform high reliability soldering and desoldering) should be selected.</p> <p>If measurement skills are required, then Unit MEM12002B (Perform electrical/electronic measurement) should also be selected. Where the selection and use of tools is required as part of the assembly process, see Units MEM18001C (Use hand tools) and MEM18002B (Use power tools/hand held operations) as appropriate.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Read and understand job sheets.	1.1.Job sheets and instructions are understood and followed correctly.
2. Select assembly equipment	2.1.Assembly equipment is selected and used in accordance with instructions or job sheets to standard operating procedures. 2.2.Equipment is used in a safe manner.
3. Identify electronic/electrical	3.1.Common name, appearance, colour of electronic

ELEMENT	PERFORMANCE CRITERIA
components	and electrical components are identified. 3.2.Polarity indicators are identified on components.
4. Assemble components	4.1. Correct components are selected by code/colour or other identification methods. 4.2. Components/devices are prepared for soldering or other termination methods. 4.3. Cables are connected to a variety of plug and socket combinations as required. 4.4. Components are safely handled and stored using appropriate anti-static handling procedures and techniques in accordance with standard operating procedures. 4.5. Assembly is produced following correct sequence of operations.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following assembly job sheets, instructions and standard operating procedures
- selecting appropriate tools and equipment
- using tools and equipment
- selecting electronic and electrical components by name, colour and appearance
- preparing components/devices for soldering and termination
- connecting cables to plugs/sockets
- handling and storing components safely
- applying anti-static handling procedures and techniques
- checking work for conformance to specification
- completing production records and reports
- following oral instructions
- using hand and power tools dedicated to the assembly process
- identifying components by name, appearance and colour
- entering routine and familiar information onto proforma and standard workplace

**REQUIRED SKILLS AND KNOWLEDGE**

forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- assembly equipment and its application
- hazards associated with the misuse of tools and equipment
- polarity indicators on common electronic and electrical components
- consequences of connecting electronic and electrical components with incorrect polarity
- termination methods
- preparation requirements for components/devices to be soldered
- preparation requirements for components/devices to be terminated using non-soldering techniques
- connection requirements of a variety of plugs and sockets
- anti-static procedures and techniques
- safe handling and storage requirements of electrical and electronic components
- consequences of not following the correct sequence of operations
- specifications against which the assembly is to be checked/tested
- test/check procedures
- data recording requirements

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform electrical/electronic assembly (production).

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with electronic/electrical assembly (production) or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Assembly
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## MEM03005B Rework and repair (electrical/electronic production)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers testing assemblies against functional requirements, identifying faults, and repairing or reworking to rectify the faults
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work undertaken on a range of components and circuit boards.</p> <p>Given a range of components and printed circuit boards, faults can be identified in accordance with established procedures, rework and repair. The employee is responsible for the quality of his/her own work.</p> <p>Applications of this unit may also require varying levels of measurement competencies.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM03004B	Perform electronic/electrical assembly

Prerequisite units		
		(production)
	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform tests	1.1.Assembly is tested for functional requirements from job sheets. 1.2.Faults in assembly or soldering are identified.
2. Identify cause of fault and rectify fault	2.1.Cause of fault is identified using standard operating procedures. 2.2.Repair and/or rework is completed according to instructions from job cards, drawings, assembly specification. 2.3.Components are safely handled and stored using appropriate anti-static handling procedures and techniques.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following job sheets/instructions, standard operating procedures and assembly drawings
- performing specified tests on the assembly
- identifying assembly or soldering faults and their causes
- obtaining all information relevant to the repair and/or rework to be undertaken
- completing repair and/or rework to specification
- safely handling and storing components
- using anti-static handling procedures and techniques
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- the functional requirements of the assembly
- assembly tests and methods
- faulty connections and components and their symptoms
- causes of faults in connections and components
- the dangers of static electricity to electrical and electronic components
- anti-static procedures and techniques
- safe handling and storage requirements of electrical and electronic components
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with rework and repair (electrical/electronic production) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Context of and specific resources for assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Method of assessment</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units	

## Competency field

Competency field	Assembly
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## MEM03006B Set assembly stations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up, adjusting and testing assembly stations according to defined procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to setting a range of assembly stations. It also includes routine maintenance of the equipment. Assembly stations may be used for a range of operations and processes.</p> <p>For setting automated assembly processes, Unit MEM07040A (Set multistage integrated processes) should be selected.</p> <p>Machine setting skills are covered by Unit MEM07003B (Perform machine setting (routine)) and Unit MEM07004B (Perform machine setting (complex)).</p> <p>Where measurement skills are required, then Unit MEM12023A (Perform engineering measurements) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM03001B	Perform manual production assembly
	MEM18001C	Use hand tools
Path 2	MEM03003B	Perform sheet and plate assembly
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
Path 3	MEM03004B	Perform electronic/electrical assembly (production)
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job	1.1.Setting requirements are correctly identified from

ELEMENT	PERFORMANCE CRITERIA
requirements	job sheets/instructions.
2. Select and use a range of hand tools and equipment	2.1. Hand tools and equipment for setting assembly stations are used in a safe manner, according to instructions, standard operating procedures and any legislative requirements.
3. Set assembly stations	3.1. Assembly stations are set up for a range of processes and operations according to defined procedures. 3.2. Safe work practices are observed and implemented. 3.3. Assembly stations are adjusted to specifications and operational requirements. 3.4. Assembly stations are tested for correct operation.
4. Maintain equipment	4.1. Routine maintenance is carried out to standard operating procedures. 4.2. Worn or damaged components are identified and changed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings for setting assembly stations
- following oral instructions
- testing and checking assembly station and outputs
- identifying worn and/or damaged components

#### Required knowledge

Look for evidence that confirms knowledge of:

- procedures to be followed in setting up assembly stations
- safety hazards associated with the assembly station and/or its setting up
- specifications applicable to the assembly station
- effect of various adjustments that can be made to the assembly station

**REQUIRED SKILLS AND KNOWLEDGE**

- routine maintenance requirements
- effect of worn or damaged components on the operational requirements and specifications of the assembly station
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to set, adjust and test assembly stations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with setting, adjusting and testing assembly stations or other units requiring the exercise of the skills and knowledge covered by this unit.



**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Job sheets/instructions**

Verbal and written job instructions, specifications, standard operating procedures and assembly drawings within the scope of this unit

**Assembly station**

May be used for operations such as riveting, pressing, screwing, tensioning etc. and processes such as testing, gluing, identification, numbering or simple hot stamping etc.

**Set up**

Ensuring that appropriate jigs, fixtures, die sets, stores and tooling etc. are in place as required to meet the production order or schedules

**Processes and operations**

Riveting, pressing, screwing, tensioning, testing, gluing, identification, numbering or simple hot

**RANGE STATEMENT**

	stamping of components and assemblies
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Assembly
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## MEM04001B Operate melting furnaces

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating a metal melting furnace.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the operation of singular or multi, coke, oil, gas fired or electric furnaces, the melting of a range of metals, and operational maintenance. Furnaces would primarily be used for continuous or staged bulk melting/smelting of metals, holding of hot liquids, or the melting of metals for production processes e.g. casting/moulding, galvanising, etc.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13004B	Work safely with molten metals/glass

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select materials	<ul style="list-style-type: none"><li>1.1.Requisitions are completed as required according to standard operating procedures.</li><li>1.2.Charge analysis is undertaken in accordance with standard operating procedures.</li><li>1.3.The charge analysis is converted to furnace charge weight using standard operating procedures.</li><li>1.4.Charge is weighed according to standard operating procedures.</li></ul>
2. Start up furnace	<ul style="list-style-type: none"><li>2.1.Furnace is inspected for any defects or damage.</li><li>2.2.Routine operational maintenance of furnace is undertaken to standard operating procedures.</li><li>2.3.Furnace is started up to standard operating procedures.</li><li>2.4.Faults are reported according to standard operating procedures.</li></ul>
3. Charge furnace	<ul style="list-style-type: none"><li>3.1.Emergency/safety procedures are identified and followed as necessary.</li><li>3.2.Materials are pre-heated if required according to standard operating procedures.</li><li>3.3.Materials are charged into furnace using standard</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	<p>operating procedures.</p> <p>3.4.Suitable areas for emergency unloading of molten metal are identified and kept available.</p>
4. Monitor furnace	<p>4.1.Furnace is maintained at optimum operating condition to standard operating procedures.</p> <p>4.2.Sample for chemical analysis is taken and remedial action is applied as required to standard operating procedures.</p> <p>4.3.Furnace is drossed and/or degassed to standard operating procedures.</p> <p>4.4.Temperature of metal is checked and adjustment made if necessary.</p>
5. Tap or unload the furnace	<p>5.1.Quantity of the required metal is identified.</p> <p>5.2.Tap rate is carried out to standard operating procedures.</p> <p>5.3.Tapping or unloading is undertaken and completed safely according to standard operating procedures.</p>
6. Shut down furnace	<p>6.1.Shut-down of furnace is completed to standard operating procedures.</p> <p>6.2.Routine operational maintenance of furnace is undertaken to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications, standard operating procedures relevant test data sheets and other standard workplace forms. May include drawings for furnace operation
- following oral instruction
- entering routine and familiar information onto proformas and standard workplace forms
- identifying faults and areas for routine repair of the furnace and performing routine maintenance as necessary

**REQUIRED SKILLS AND KNOWLEDGE**

- following procedures for starting and closing down the furnace
- deciding on charge materials
- weighing charge materials
- feeding materials into furnace
- measuring metal temperature and correcting as necessary
- sampling for chemical, carbon equivalent and wedge tests
- degassing as necessary
- deslagging/drossing
- tapping the metal

**Required knowledge**

Look for evidence that confirms knowledge of:

- refractory conditions, faults, and routine repair
- condition of cooling water supply
- starting procedures for different types of furnaces
- metallic charge materials and alloying elements
- weighing procedures and scale types
- correct order of loading of different charge materials
- thermocouple condition monitoring and adjustment mechanism for furnace
- interpretation of carbon equivalent and wedge test results
- degassing procedures including tablet, lance and other procedures
- coagulant agents, application procedures and slag removal procedures
- close-down procedures
- applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with operating melting furnaces

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to operate a melting furnace. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating melting furnaces or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Furnace</b>	Singular or multi, coke, oil, gas fired or electric induction, arc and resistance furnaces
<b>Operational maintenance</b>	Routine lubrication, cleaning, routine repair/repointing of refractory

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04002B Perform gravity die casting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing equipment for die casting, manually pouring the metal, removing the material and cleaning the die.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to gravity casting into permanent die. All work is carried out to predetermined specifications and standards of quality and safety.</p> <p>Metals used in this area may include aluminium, aluminium alloys and other non-ferrous and ferrous metals.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13004B	Work safely with molten metals/glass

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare equipment	1.1.Die coat is mixed in correct proportion. 1.2.Die temperatures are lifted to, or maintained, at the correct level. 1.3.Appropriate safety clothing and apparatus is used. 1.4.Die coat is applied in correct sequence and in a safe manner according to standard operating procedures. 1.5.Die is correctly located and closed. 1.6.Die is correctly placed on machine, toggle clamps are attached and done up to required torque. 1.7.Air cooling is attached to the die as specified if required.
2. Carry out manual pouring	2.1.Pour is made in manner to reduce porosity and lamination. 2.2.Conditions are identified that contribute to inferior castings or rejects. 2.3.Allowance is made for adequate cooling time. 2.4.Pour is made at a continuous and appropriate rate during filling.

ELEMENT	PERFORMANCE CRITERIA
	2.5. Monitoring of die coating condition is carried out and re-spraying occurs as required.
3. Remove materials	3.1. Parts are removed and stored in a manner that minimises damage. Any flash is removed from the die surface.
4. Clean die	4.1. Shot blaster is operated in a safe manner and according to standard operating procedures. 4.2. Chemical analysis of melt is taken and remedial action is applied as required to standard operating procedures. 4.3. Furnace is drossed and/or degassed to standard operating procedures. 4.4. Work area is cleaned of coating and shot residue to appropriate standard.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings relating to gravity die casting
- mixing of die coats in the correct proportions in accordance with standard operating procedures
- maintaining of die at correct temperatures
- pouring of molten metal
- assessing correct curing times
- applying die coats
- removing of casting from die
- operating shot blaster
- using measurement skills needed to meet the requirements of this unit
- entering routine and familiar information onto proforma and standard workplace forms

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- relevant written instructions
- die coat function(s) in gravity die casting
- correct proportions and consistency of die coats
- correct identification of die coat materials
- procedures for raising the temperature of the die to the correct level and maintaining the required temperature
- procedures to be followed when pouring molten metal to produce sound castings
- causes of defects in castings
- curing times for castings of various volumes and materials
- timing of die coat application and quantity of die coat to be used for different applications
- correct procedures for removing castings from the die and storing of castings
- die condition and need for shot blasting
- shot blaster operating procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with gravity die casting, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to undertake gravity die casting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gravity die casting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Correct proportions</b>	Will be determined by manufacturer specifications
<b>Die temperatures</b>	Will vary according to standard operating procedures and/or organisation's procedures
<b>Appropriate safety clothing and apparatus</b>	Aluminium Association safety status sheet recommendations, glasses, aluminised suits, masks, gloves, gauntlet, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04003B Operate pressure die casting machine

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers starting, operating and shutting down pressure die casting machines.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all pressure die casting machines. All work is carried out to predetermined specifications and standards of quality and safety. Work may be carried out autonomously or as part of a work team.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13004B	Work safely with molten metals/glass

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Conduct pre-operational checks	<p>1.1.The start-up procedure is conducted according to standard operating procedures.</p> <p>1.2.If necessary, the shot size is adjusted.</p> <p>1.3.If applicable, nitrogen and/or vacuum systems are checked</p> <p>1.4.If applicable, a functional check is made of the picking robot, and the component gripper is adjusted if necessary.</p> <p>1.5.Die spray nozzles are adjusted as necessary.</p> <p>1.6.Planning is carried out which ensures efficient flow of finished product i.e. breaking of runners, stacking baskets, bins, conveyors.</p>
2. Operate all functions on machine control panel	2.1.Appropriate knowledge of die casting process is applied to the operation, adjustment and monitoring of machine functions.
3. Operate machine to produce castings	<p>3.1.The die casting machine is operated to standard operating procedures, including maintenance of liquid metal and die operating conditions.</p> <p>3.2.Runners are broken off correctly.</p> <p>3.3.Castings are visually inspected for porosity, cracks, tears, splits, sinks, cold shuts, tinning and die surface crazing according to standard operating procedures.</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>3.4. Castings are handled in a manner that minimises risk of damage to the casting and injury to personnel.</p> <p>3.5. First-off castings are produced, visually inspected and submitted for checking against specifications.</p>
4. Monitor furnace	4.1. The furnace is maintained at optimum operating condition to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following information on written job procedures and specifications
- performing pre-start checks
- adjusting the shot size
- checking nitrogen and/or vacuum systems for correct operation
- checking and adjusting the picking robot and component gripper
- adjusting die spray nozzles
- sequencing of operations
- starting, operating and shutting down a die casting machine
- visually checking for conformance to specifications
- handling castings

#### Required knowledge

Look for evidence that confirms knowledge of:

- procedures for pre-start checks
- procedures for starting up the die casting machine
- adjustments that can be made to ensure correct operation of the machine
- procedures for adjusting the shot size
- the effects of incorrect shot size on the quality of the die casting
- the function of nitrogen and vacuum systems in the die casting process
- the procedures for checking/ adjusting nitrogen and/or vacuum systems
- the function of a picking robot and the component gripper
- procedures for adjusting the picking robot

**REQUIRED SKILLS AND KNOWLEDGE**

- the effects of adjustments on robot performance
- the reasons for spraying the die
- procedures for adjusting the die spray nozzles
- operations to be performed subsequent to the die casting of the product
- tools and equipment
- methods of transporting/conveying the die cast product
- the die casting process
- the effect of adjusting each machine control on the quality of the die casting produced
- procedures to adjust the operation of the die casting machine
- die casting machine operation
- maintenance of liquid levels
- operating parameters
- procedures to remove runners from the die casting
- procedures to inspect die castings
- common faults in die castings and probable causes
- damage that can be caused to castings through inappropriate handling and storage
- procedures for checking first-off castings for conformance to specification
- specifications of the die cast product
- shut-down procedures
- hazards and control measures associated with operating a die casting machine, including housekeeping
- safe work practices and procedures
- use and application of personal protective equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to operate a pressure die casting machine. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and**

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating a pressure die casting machine or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Casting and moulding
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## MEM04004B Prepare and mix sand for metal moulding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers loading up a mixer, mixing the sand, taking test samples and interpreting the results, discharging the sand and cleaning the mixer.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the mixing of moulding sand in continuous and batch type mills.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Load mixer (mill/muller)	1.1.All pre start-up checks are performed safely and according to standard operating procedures. 1.2.Formula for sand mix is determined according to standard operating procedures. 1.3.Materials are measured and loaded according to formula specification.
2. Mix sand	2.1.Sand is mixed for correct time to specifications. 2.2.The performance of mixer and the condition of the sand is monitored. 2.3.Material supply is maintained. 2.4.Faults are reported.
3. Take and test samples	3.1.Sample is correctly extracted. 3.2.Test is applied in accordance with standard operating procedures. 3.3.Test results are compared against specifications. 3.4.Adjustments to formula/mix are made as required in accordance with standard operating procedures.
4. Discharge mixture	4.1.Load is charged correctly according to standard operating procedures. 4.2.Unwanted treated sand is disposed of according to standard operating procedures.

ELEMENT	PERFORMANCE CRITERIA
5. Clean mixer	<p>5.1.Mixer is shut down to standard safety and operating procedures.</p> <p>5.2.Mixer is cleaned according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following written instructions and standard operating procedures
- setting parameters for mixing
- loading mixers
- mixing sand and monitoring the process
- sampling and testing mixed sand
- discharging sand
- closing down and cleaning
- using measurement skills for preparing and mixing sand within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics, safe handling procedure and mixture applications of sand and binding agent
- moulding requirements
- mixers, applications, loading, operating and unloading procedures
- volumes, quantities, ratios and percentages
- sampling, testing and acceptance criteria for mixed sand
- procedures for cleaning and shutting down mixer
- environmental requirements for the disposal of unwanted sand
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures related to preparing and mixing sand for metal moulding



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare and mix moulding sand.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with mixing moulding sand or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Materials</b>	Sand, silica, zircon, chromite, mixtures, water
<b>Faults</b>	Chemical ratios - acid, binder, water
<b>Mixer</b>	Batch and continuous mixers

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Casting and moulding
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## MEM04005C Produce moulds and cores by hand (jobbing)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers manual making (jobbing) of sand moulds and cores for metal casting typically in a working foundry. Moulds are made by an Engineering Tradesperson - Fabrication from specifications, instructions or drawings.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to the production of sand moulds and cores by a foundry tradesperson often called a moulder using manual (jobbing) methods to produce metal castings. The unit does not cover machine moulding. The jobbing moulding methods covered by this unit apply to a range of materials and types of patterns and require matching of job specifications and patterns to mould and core production based on knowledge of the metal casting process.</p> <p>This unit has been developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in the production of moulds and cores. The ability to match patterns, moulds and cores for a wide range of jobs is a key trade skill and can usually only be gained from experience in the range of work and the combination of on and off-the-job training typical of an apprenticeship.</p> <p>Where lifting and moving moulds and cores requires the use of mobile load shifting equipment or overhead cranes, appropriate manual handling units should also be selected. Where the securing of moulds requires welding skills, refer to MEM05012C Perform routine manual metal arc welding and MEM05050B Perform routine gas metal arc welding, as appropriate.</p>
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	<b>Band: A</b> <b>Unit Weight: 16</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job	1.1.Job requirements are correctly identified from

ELEMENT	PERFORMANCE CRITERIA
requirements	<p>drawings, instructions and specifications</p> <p>1.2. Material is selected appropriate to job requirements</p>
2. Determine sequence of operation	<p>2.1. Sequence of operation including job set up is determined for maximum safety, efficiency and to meet job specifications</p>
3. Select inspect and prepare pattern equipment	<p>3.1. Pattern equipment is correctly identified from specifications to standard operating procedures</p> <p>3.2. Pattern equipment is inspected to specifications, and damaged patterns are identified for repair or replacement to standard operating procedures</p> <p>3.3. Pattern is assembled to specification</p> <p>3.4. Pattern equipment is set up to specification according to standard operating procedures</p>
4. Make mould and core	<p>4.1. Core is positioned in prints utilising chaplets and chills as required and vented to specification according to standard operating procedures</p> <p>4.2. Mould is closed and checked for compliance to component specification in accordance with standard operating procedures</p> <p>4.3. Appropriate moulding/core making equipment is selected and positioned according to standard operating procedures</p> <p>4.4. Appropriate moulding media is selected to produce mould and core to specification</p> <p>4.5. Mould is secured according to standard operating procedures</p> <p>4.6. Moulding media is used to produce mould and core according to standard operating procedures</p> <p>4.7. Pouring basin is selected or manufactured to specification and positioned in accordance with standard operating procedures</p> <p>4.8. Mould and cores are rammed up with joints and drawbacks as required to standard operating procedures</p> <p>4.9. Parting and stripping systems are utilised in accordance with standard operating procedures</p> <p>4.10. Loose pieces, vents, risers and runners are positioned and secured as required to standard operating procedures</p> <p>4.11. Pattern and loose pieces are removed from mould and core box in a safe manner least likely to cause damage to the pattern and in accordance with</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>standard operating procedures</p> <p>4.12. Mould is inspected and repaired as required</p> <p>4.13. Mould and core is cleaned and painted according to specification using standard operating procedures</p>
5. Clean and restore work area	<p>5.1. All materials/debris is cleared and work site cleaned and left in a safe state</p> <p>5.2. Unwanted treated sand is disposed of according to standard operating procedures and legislative and statutory requirements</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- interpreting written instructions, sketches and drawings
- assembling and positioning patterns in moulding boxes
- positioning ancillary methoding components
- preparing moulding media
- filling and compacting mould assemblies
- stripping patterns
- inspecting moulds
- finishing moulds
- positioning cores in prints
- closing moulds
- placing pouring basins
- securing moulds
- following oral instructions
- entering routine and familiar information onto proforma and standard workplace forms

#### Required knowledge

Required knowledge includes:

## REQUIRED SKILLS AND KNOWLEDGE

- metal casting process
- variety of pattern types and their application in a casting process
- pattern assembly techniques
- selection of a moulding box to match job and pattern
- principles and processes for selection of ancillary components
- sand types and their bonding systems
- compaction processes
- parting and stripping systems
- mould requirements including vents, runners, risers and other methoding requirements
- finishing and closing techniques
- core placement
- pouring requirements
- securing systems
- pattern care and storage
- environmental requirements
- use and application of personal protective equipment
- foundry safe work practices and procedures
- hazards and control measures associated with producing moulds and cores by hand (jobbing)

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to produce a range of jobbing moulds and cores by hand. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- following all safety procedures for working safely in



**EVIDENCE GUIDE**

	<p>a typical working foundry environment</p> <ul style="list-style-type: none"> <li>• knowledge of the casting process including the role of patterns, sands, moulds and cores, and the importance of correct methoding</li> <li>• matching of specifications, sketches and drawings to mould and core requirements for a range of patterns, metals and sands</li> <li>• planning skills are evident in sequence of work, selection and layout of materials, and construction of moulds and cores</li> <li>• appropriately identifying, assembling and determining patterns as fit for purpose</li> <li>• ensuring core positioning is in accordance with job specifications</li> <li>• placing methoding components in accordance with job specifications</li> <li>• selecting moulding equipment and media to match a range of job requirements</li> <li>• making moulds, cores and pouring basins for a range of jobs and metals efficiently and to meet all safety requirements with minimum waste of materials</li> <li>• disposing of used sand and debris according to standard operating procedures and regulations.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level jobbing moulding skills as applied to a jobbing moulding environment.</p> <p>Assessment resources include a furnace to supply adequate molten metal for testing of moulds and cores, sand and other materials to enable enough sufficient moulds and cores to be produced and all normal foundry safety and personal protective equipment.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>The emphasis for assessment should be on jobbing ability, that is, the ability to produce moulds and cores for a variety of job specifications involving different metals, sands and patterns.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off</p>

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	<p>the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing jobbing moulds and cores by hand or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Materials</b>	Materials may include: <ul style="list-style-type: none"> <li>• binders</li> <li>• hardeners</li> <li>• sand additives</li> <li>• mould coatings</li> </ul>
<b>Patterns</b>	Patterns may include: <ul style="list-style-type: none"> <li>• flatback</li> <li>• uneven</li> <li>• plated patterns</li> <li>• multi-joint</li> <li>• consumable</li> <li>• split patterns</li> <li>• loose piece patterns</li> <li>• patterns requiring odd sides</li> <li>• cored moulds</li> <li>• drag and cope mould</li> </ul>
<b>Moulds</b>	Moulds may include: <ul style="list-style-type: none"> <li>• flatback</li> <li>• uneven jointed</li> <li>• multi-part moulds</li> </ul>
<b>Cores</b>	Cores may include full, half and segment cores
<b>Mould securing methods</b>	Mould securing methods may include: <ul style="list-style-type: none"> <li>• weights</li> <li>• clamps</li> <li>• bolting</li> </ul>
<b>Moulding media</b>	Moulding media may include use of a wide range of sands including green sand, shell sand and chemically bonded media
<b>Pouring basins</b>	Pouring basins may include hand and pattern formed
<b>Parting and stripping systems</b>	Parting and stripping systems may include dry and wet

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04006B Operate sand moulding and core making machines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating automatic and semi-automatic sand moulding and core making machines.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the operation of a range of automatic and semi-automatic sand moulding and core making machines in a foundry using a range of moulding media such as green sand, shell sand, chemically bonded media.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Instructions and specifications are interpreted correctly.
2. Conduct pre-operational checks	2.1. Pattern/core box is selected and inspected to specifications and cleaned as required. Damaged patterns/core boxes are identified for repair or replacement to standard operating procedures. 2.2. Pattern/core box is set up in bolster and core box according to standard operating procedures.
3. Operate machine to produce mould/cores	3.1. Appropriate moulding media is selected to produce mould and core to specification. 3.2. Moulds/cores are filled to specification according to standard operating procedures. 3.3. Machine is operated in accordance with standard operating procedures. 3.4. Machine is unloaded safely to standard operating procedures. 3.5. Moulds/cores are stripped, inspected and painted as required according to standard operating procedures.
4. Assemble moulds/cores	4.1. Moulds/cores are dried, glued and vented as required to specification and closed in accordance with standard operating procedures. 4.2. Runner bush is set to specification as required.

ELEMENT	PERFORMANCE CRITERIA
5. Clean and restore work area	<p>5.1.All material/debris is cleared and work site is cleaned and left in a safe state.</p> <p>5.2.Unwanted treated sand is disposed of according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting written instructions and specifications
- preparing and installing pattern or core box
- programming operating parameters
- operating and monitoring moulding and core making machines
- assembling moulds and cores
- inserting cores (in moulding machines)
- inserting runner bushes
- maintaining integrity of mould or core
- maintaining integration of interrelated metal melting, core making and sand mixing processes
- maintaining operational capability of moulding and core making machines
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics and applications of sand and binding agents
- machine operation, fault identification, analysis and rectification procedures
- core selection and loading procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with operating sand moulding and core making machines

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to operate a sand moulding and core making machine.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operation of sand moulding and core making machines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,



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	standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Moulding media</b>	Shell, chemically bonded or green sand as appropriate for the particular machine
<b>Machine</b>	Automatic, semi-automatic, moulding and core making

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Casting and moulding
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## MEM04007B Pour molten metal

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers manually pouring molten metal.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manual pouring of molten metal as part of metal casting and moulding processes.</p> <p>Where lifting and moving of ladles requires the use of overhead cranes, applicable units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13004B	Work safely with molten metals/glass

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for pouring molten metal	1.1.The condition of the mould is checked according to standard operating procedures. 1.2.The condition of the ladle is checked according to standard operating procedures. 1.3.The temperature of molten metal is checked for conformance to specification, and pouring method is sequenced to standard operating procedures. 1.4.The capacity of the required pour is identified against specification according to standard operating procedures.
2. Preheat or prepare ladle	2.1.The ladle is preheated/prepared to receive molten metal.
3. Transfer ladle to furnace	3.1.Safety clips are checked according to standard operating procedures. 3.2.The ladle is filled and transferred to the pouring area in accordance with standard operating procedures. 3.3.Additives are determined from specification and added to molten metal as required.
4. Maintain quality of metal as required	4.1.Slag/dross is removed where necessary. 4.2.The temperature is monitored as required. 4.3.Chemical analysis is undertaken and remedial action is applied as required to standard operating

ELEMENT	PERFORMANCE CRITERIA
	procedures.
5. Pour molten metal	<p>5.1. Personnel in the immediate area of the metal pour are informed that pour is to take place and appropriate safety clothing and equipment is used as specified in standard operating procedures.</p> <p>5.2. Metal is poured safely to specification and in accordance with standard operating procedures.</p> <p>5.3. Metal is poured at an appropriate and continuous rate.</p> <p>5.4. A test bar is poured in accordance with standard operating procedures as required.</p>
6. Empty excess metal from ladle	6.1. Pigs are poured and tagged.
7. Return ladle	7.1. The ladle is emptied, cleaned and maintained according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following written instructions, standard operating procedures, specifications and standard test data sheets
- selecting and checking ladle
- preparing ladle for pouring
- transferring metal to ladle
- treating metal
- removing slag and dross
- sampling and testing molten metal
- pouring molten metal into moulds and pigs
- tagging pig metal
- using communication skills to effectively transfer skills and knowledge to employees

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- types and pouring characteristics of metals
- types and characteristics of ladles
- procedures for maintaining condition and integrity of ladle
- procedures for safe handling and transference of molten metal
- metal treatments, applications and procedures for making additions to molten metal
- slag and dross removing procedures
- techniques for sampling and testing molten metal
- pouring procedures
- metal identification and tagging procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with pouring molten metal

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to pour molten metal. Competency in this unit cannot be Claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working

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	<p>alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with pouring molten metal or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Ladle</b>	Lip pour, tea pot, bottom pour, barrel, and bull ladles of varying capacity
<b>Additives</b>	Alloys, inoculants, spheroidisers, coagulants

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04008B Fettle and trim metal castings/forgings

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers fettling and trimming metal castings and assessing the quality of the casting.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to dressing and assessing quality of metal castings/forgings in production and jobbing environments.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Job requirements are correctly determined from instructions and specifications.</p> <p>1.2.Correct mouldings and/or castings/forgings are located and arranged for efficient processing.</p>
2. Observe safety requirements	<p>2.1.Personal protective equipment is selected and used correctly.</p> <p>2.2.Castings/forgings are handled using manual or mechanical handling methods appropriate to the task.</p> <p>2.3.Castings/forgings are stored or positioned in a safe manner.</p>
3. Identify excess material for removal	<p>3.1.Casting is removed from mould and/or sand media is removed from casting as required.</p> <p>3.2.Castings/forgings are visually checked as suitable for further processing, and excess metal is correctly identified according to standard operating procedures.</p>
4. Select correct tools and equipment	<p>4.1.Cleaning method is selected appropriate to casting and job requirements.</p> <p>4.2.Rumbling/shot blast/sand blast equipment is set to specification and used in accordance with standard operating procedures as required.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>4.3.Appropriate hand tools are selected and used for the given task.</p> <p>4.4.Appropriate power tools and accessories are selected and used for the given task.</p>
5. Remove excess material	<p>5.1.Excess metal (e.g. runners, risers and flashing) is removed using methods and equipment appropriate to the task and to standard operating procedures.</p> <p>5.2.Excess metal suitable for recycling is identified according to standard operating procedures.</p> <p>5.3.Excess metallic materials are identified from specifications and isolated as required according to standard operating procedures.</p>
6. Quality assess castings/forgings	<p>6.1.Castings/forgings are visually checked for conformance with specifications to standard operating procedures.</p> <p>6.2.Non-conforming castings/forgings are rejected or set aside and identified for further consideration or remedial action according to standard operating procedures.</p> <p>6.3.Faults are reported/recorded as required according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting written instruction sketches and drawings
- identifying castings
- visually inspecting castings
- fettling and trimming metal castings/forgings
- conducting a final inspection

#### Required knowledge

Look for evidence that confirms knowledge of:

**REQUIRED SKILLS AND KNOWLEDGE**

- accept/reject/rework criteria
- fettling requirements
- fettling tools
- fettling standards
- handling and storage requirements
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with fettling and trimming metal castings/forgings
- excess metals suitable for recycling

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to fettle and trim metal castings/forgings. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with fettling and trimming metal castings/forgings or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Hand tools</b>	Dedicated tools for fettling and trimming: files, chisels, hammers etc.
<b>Power tools</b>	Saws, croppers, grinding disks/belts (including grades), swing and pedestal grinders etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04010B Develop and manufacture wood patterns

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers developing and manufacturing wood patterns, both regular shaped and split patterns, based on an understanding of casting and moulding principles.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of all types of solid, split and turned wood patterns and wood pattern component parts, including but is not limited to general engineering patterns, master patterns with multiple contraction, skeleton, frame and strickle, wheels, pulleys, chain sheaves, impellers etc.</p> <p>Patterns may be constructed by laminating timber and timber composites, stave and lag, box or frame construction or any alternative method that minimises timber shrinkage, warp and achieves required strength. A full range of timber and timber composites may be used.</p> <p>Solid patterns may be set up on a regular or irregular joint. Turned patterns are manufactured using tools and machines appropriate for shaping wood. This unit covers all specifications interpreted from drawings, technical sketches and/or customer requirements.</p> <p>Tasks undertaken include utilising appropriate wood pattern making principles and techniques, designated procedures, correct and appropriate tools and equipment.</p> <p>If patterns are set up on pattern plates, see Unit MEM04012B (Assemble plated patterns).</p> <p>For the development and manufacture of marine propellers, conveyor screws, cast gears etc., Unit MEM04017B (Develop and manufacture gear, conveyor screw and propeller patterns) should also be considered.</p> <p>Where precision measurement is required, Unit</p>
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	<p>MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p>This unit should not be selected when Unit MEM18014B (Manufacture tools, gauges and dies) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 20</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Job instructions and specifications are interpreted correctly.</p> <p>1.2.Type of wood pattern required is determined through application of moulding/casting techniques and foundry processes.</p> <p>1.3.Appropriate timber/timber composites are selected to meet specification.</p>
2. Develop and lay out wood patterns	<p>2.1.Pattern parameters are calculated to specification e.g. angles, tapers, clearances, contractions etc.</p> <p>2.2.Pattern is laid out showing tapers, machining allowances, core prints and method of construction to specification.</p> <p>2.3.Jigs and fixtures are developed and manufactured to aid wood pattern manufacture as required.</p>
3. Manufacture wood patterns	<p>3.1.Materials are marked out and construction is developed to meet specification.</p> <p>3.2.Using acceptable wood pattern making techniques and procedures, and utilising appropriate hand and handheld power tools, pattern or pattern component parts are produced to size and shape and checked for conformance to specifications.</p> <p>3.3.Using acceptable wood pattern making techniques and procedures, pattern component parts are joined</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>or fixed as required and checked for conformance to specification.</p> <p>3.4. Pattern is correctly marked, colour coded or tagged to specifications or standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading/interpreting/following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other documents
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- selecting appropriate timber to suit the moulding/casting techniques and foundry process
- laying out the pattern/core boxes
- constructing patterns/core boxes
- joining and fixing component parts
- pattern checking

#### Required knowledge

Look for evidence that confirms knowledge of:

- timber products including features, characteristics and applications
- moulding and casting techniques
- tooling required for casting/moulding
- methoding techniques
- the use and application of jigs and fixtures
- methods of construction
- the formulae and mathematical techniques required for necessary manufacturing of patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc.
- identification coding and numbering
- pattern checking techniques
- mouldability i.e. surface finish, face taper, convex or concave perspectives,

**REQUIRED SKILLS AND KNOWLEDGE**

- undercuts, etc.
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with the development and manufacture of wood patterns

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and manufacturing wood patterns or other units requiring the exercise of the skills and knowledge covered by this unit.

**Context of and specific resources for assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those

**EVIDENCE GUIDE**

	required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Method of assessment</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Moulding/casting techniques</b>	The variety of sand moulding techniques and sand mediums
<b>Timber/timber composites</b>	Hardwood, softwood, laminates, plywood, veneers and bonded fibreboard
<b>Calculations</b>	Calculations include the determination of contraction rates, as well as general engineering calculations
<b>Joining and fixing</b>	Glued, screwed, nailed, stapled

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04011B Produce polymer patterns

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers designing, manufacturing and finishing polymer patterns.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of investment casting dies and polymer patterns for medium production castings, core boxes, tooling aids, jigs and checking fixtures etc.</p> <p>Construction includes, but is not limited to, solid polymer, filled, laminated fibreglass or metal inserts.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements

<b>Prerequisite units</b>		
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare patterns and cores	1.1. Patterns or cores are inspected for appropriate surface finish and set up on jointline or flat board to specification. 1.2. Appropriate parting agent is selected and applied to polymer specifications.
2. Manufacture moulds, patterns, tooling aids etc.	2.1. Appropriate polymer materials are selected to specification. 2.2. Polymer and hardener are mixed to correct ratios and specifications using standard safety and operating procedures. 2.3. Polymer is applied to specification and using predetermined methods, ensuring that air is not entrapped in application, excessive heat is not

ELEMENT	PERFORMANCE CRITERIA
	<p>generated and delamination does not occur in final use.</p> <p>2.4. Pattern/core box is stripped, inspected, cleaned and repaired as required.</p> <p>2.5. Faces of polymer pattern are machined and finished to specifications.</p> <p>2.6. Appropriate method of location is applied to patterns and core boxes.</p> <p>2.7. Polymer tooling is checked for conformance to specifications as required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit, including determination of contraction rates
- measuring polymer materials
- interpreting written instructions, sketches and drawings
- making master patterns
- machining patterns/core boxes and tooling aids
- sealing the patterns or cores with appropriate surface finish
- alignment of pattern to core box
- setting up with necessary locations
- applying the parting agents
- selecting polymers
- preparing polymer and hardener
- applying polymer coating
- releasing patterns and moulds
- cleaning patterns and moulds

#### Required knowledge



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- machining for pattern making
- parting agents
- safe working procedures
- methods of locating patterns and core boxes
- the range of surface finishes
- range of polymers and their applications
- mixing ratios and calculations
- characteristics of polymer under exothermic reaction
- exothermic control procedures
- methods of stripping
- pattern checking techniques
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with producing polymer patterns

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce polymer patterns. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not

<b>EVIDENCE GUIDE</b>	
	<p>require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing polymer patterns or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Surface finish</b>	Texture, gel coat, aluminium fill

RANGE STATEMENT	
Parting agent	Wax, PVA
Polymer materials	Epoxy resins, urethane
Method of location	Male and female joint, pin and bush

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Casting and moulding
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## MEM04012B Assemble plated patterns

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assembling plated patterns.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the assembly of all types of plated patterns using a range of materials such as timber, timber composite and metal. It covers the manufacture (when appropriate) and mounting of runner systems.</p> <p>This unit does not address machining competencies. If these are required, appropriate units should also be accessed.</p> <p>For cast aluminium plates, see Unit MEM04014B (Develop and manufacture production patterns). Where the manufacture of polymer-plated patterns is required, Unit MEM04011B (Produce polymer patterns) should also be accessed.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04010B	Develop and manufacture wood patterns
	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job instructions and specifications are correctly interpreted and followed.
2. Inspect and layout patterns	2.1.Pattern(s) are inspected to ensure dimensions and surface finish conform to specifications. 2.2.Pattern and runner system is laid out to specifications from drawings, sketches or verbal instructions. 2.3.Pattern(s) are correctly aligned.
3. Mount pattern on plates	3.1.Cope and drag patterns/double sided match plate patterns are attached to pattern plate/s according to specification. 3.2.Cope and drag patterns/double sided match plate patterns are inspected for security and alignment.
4. Mount runner system	4.1.Volume of runner system conforms to specification. 4.2.Runner components are attached to pattern plates using appropriate fixing and joining techniques to specification.
5. Inspect plated pattern assembly	5.1.Surface and mouldability of plated pattern assembly are inspected for compliance with specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining job requirements from written instructions, specifications, sketches and drawings
- planning and sequencing tasks
- checking and clarifying task-related information
- performing relevant calculations
- following verbal instructions
- applying surface finishes for the moulding process
- laying out patterns and runner systems

**REQUIRED SKILLS AND KNOWLEDGE**

- attaching pattern and runner components
- locating and aligning patterns
- checking patterns for compliance

**Required knowledge**

Look for evidence that confirms knowledge of:

- units of measurement, numerical operations and calculations associated with assembling plated patterns
- fixing and drilling techniques
- the reason for using particular layout and runner system
- types of pattern plates
- the techniques for avoiding cross jointing or mismatch of the pattern and their relationship to the pin-centre
- methoding systems
- mouldability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc.
- moulding and casting techniques
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with assembling plated patterns

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assemble plated patterns. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assembling plated patterns or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>



<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Aligned</b>	Measurement and/or dowels
<b>Calculations</b>	The determination of contraction rates as well as applicable general engineering calculations

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04013B Develop and manufacture polystyrene patterns

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	
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### Application of the Unit

Application of the unit	<p>This unit covers all patterns using polystyrene, including patterns for the lost foam process and for those areas on a wood pattern and core box where polystyrene is required.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units		
Path 1	MEM04010B	Develop and manufacture wood patterns
	MEM04018B	Perform general woodworking machine operations

Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood.

ELEMENT	PERFORMANCE CRITERIA
	1.2.The appropriate grade/type of polystyrene is selected to meet specifications.
2. Mark out pattern	2.1.Calculations are performed to determine contraction allowance etc. 2.2.Pattern/pattern components are marked out to specifications.
3. Manufacture pattern	3.1.Pattern components are correctly jointed and secured using adhesives appropriate to the task. 3.2.Appropriate tools are selected and techniques are used to manufacture polystyrene patterns to specification. 3.3.Pattern is checked for conformance to specifications and correctly marked for identification.
4. Protect pattern from damage	4.1.Patterns are handled and stored in a safe manner least likely to cause damage using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining job requirements from written instructions, sketches and drawings
- planning and sequencing tasks/operations
- checking and clarifying task-related information
- selecting polystyrene appropriate for pattern or foundry process
- marking out in relation to polystyrene patterns
- selecting and applying adhesives
- manufacturing polystyrene patterns
- checking patterns for compliance
- handling finished polystyrene products
- using calculations to determine contraction allowances

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- types and applications of polystyrene for pattern making
- the formulae and mathematical techniques required for manufacturing patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc.
- marking out techniques for polystyrene patterns
- undercuts and holes
- types and applications of adhesives
- tools and their uses in the manufacture of polystyrene patterns
- pattern checking techniques
- handling and storage techniques
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with developing and manufacturing polystyrene patterns

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to develop and manufacture polystyrene patterns. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with pattern making in polystyrene or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Grade/type</b>	Size and density of bead
<b>Adhesives</b>	PVA, 'hot glue'
<b>Tools</b>	Hot wire, knives, saws

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04014B Develop and manufacture production patterns

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	
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### Application of the Unit

Application of the unit	<p>This unit applies to the manufacture of all types of metal patterns, master patterns, core boxes and associated equipment including cast plates etc., applying pattern making principles.</p> <p>Patterns may be made directly or from a master pattern.</p> <p>Patterns may be integral with the plate or mounted to the plates with gating. Depending upon specifications, production core boxes also may be loose or mounted into core box rigs etc.</p> <p>Patterns and core boxes are manufactured from a range of ferrous, non-ferrous and alloy materials, using a range of metal cutting and shaping tools and machines.</p> <p>Where the manufacture of polymer production patterns is required, Unit MEM04011B (Produce polymer patterns) should be considered.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM04010B	Develop and manufacture wood patterns
	MEM04012B	Assemble plated patterns
	MEM04018B	Perform general woodworking machine operations
	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1. Drawings, instructions and specifications are interpreted and understood.</p> <p>1.2. Pattern type and design is conceptualised and planned with reference to customer's specification (written or verbal) for number, layout, runner system and core box design.</p> <p>1.3. Pattern design is interpreted and visualised from drawings, prints or plans and checked against customer requirements.</p> <p>1.4. A plan is developed for sequence of manufacture for either a high or low volume foundry production pattern.</p>
2. Develop pattern equipment	<p>2.1. Appropriate materials are selected and obtained to meet requirements of strength, durability and component finish etc.</p> <p>2.2. Calculations appropriate to establishing pattern parameters are performed, including angles, tapers, contraction, etc. where applicable.</p>
3. Manufacture production patterns and core boxes	<p>3.1. Appropriate machines and machining process are selected to shape/produce production patterns and core boxes to specification.</p> <p>3.2. A range of hand and hand held power tools are selected to fashion/manufacture production patterns and core boxes to specification.</p> <p>3.3. Production patterns and core boxes are checked to specification and surface finish and are checked for mouldability.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining job requirements from written instructions, sketches and drawings
- planning and sequencing manufacturing operations
- checking and clarifying task-related information
- selecting appropriate metals to suit the moulding/casting techniques and foundry process
- laying out/constructing production pattern/core boxes
- joining and fixing component parts
- checking pattern for conformance to specifications
- measuring components to specified tolerances
- calculating contraction rates

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics of metals and alloys and their application in the development/manufacture of production patterns
- tolerances and contraction rates typically used in the manufacture of production patterns
- production moulding and casting techniques
- tooling required for casting/moulding
- methoding techniques
- the use and application of jigs and fixtures
- methods of construction including machining provision and clamping arrangements
- appropriate techniques, tools and equipment to measure, mark out and produce production patterns
- the formulae and mathematical techniques required for manufacturing production patterns/core boxes i.e. contraction, taper, clearances, machining allowances etc.
- identification coding and numbering
- pattern checking techniques
- mouldability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc.
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with developing and manufacturing production patterns

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to develop and manufacture production patterns. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and manufacturing production patterns or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

<b>EVIDENCE GUIDE</b>	
	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Appropriate materials</b>	A range of ferrous, non-ferrous and alloy materials
<b>Calculations</b>	The determination of contraction rates as well as general engineering calculations
<b>Appropriate machines</b>	Lathes, milling machines, grinders, pedestal drills, pantographs and other machines as needed

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04015B Develop and manufacture vacuum forming moulds and associated equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers developing and manufacturing all types of vacuum forming moulds and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of all types of vacuum forming equipment, utilising a range of materials such as timber, composites, polymer, metal etc., appropriate pattern making principles and techniques, designated procedures, and correct and appropriate tools and equipment.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p>Where assembly of plated patterns is required, Unit MEM04012B (Assemble plated patterns) should be considered.</p> <p>Where manufacture of production patterns is required, Unit MEM04014B (Develop and manufacture production patterns) should be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04010B	Develop and manufacture wood patterns
	MEM04011B	Produce polymer patterns
	MEM04018B	Perform general woodworking machine operations
	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood. 1.2. Vacuum forming processes are applied to determine the design of vacuum forming moulds and associated equipment to be constructed. 1.3. Appropriate material is selected to meet specifications.
2. Develop and mark out pattern for vacuum forming	2.1. Pattern parameters are calculated, taking into account plastic sheet thickness and shrinkage etc. 2.2. Vacuum forming pattern is marked out, showing size and position of air evacuation and of the moulded form.
3. Manufacture pattern for vacuum forming	3.1. Appropriate machines and machining process are selected to shape/produce vacuum forming pattern to specification. 3.2. A range of hand and hand held power tools are selected and used to fashion/manufacture vacuum forming patterns to specification. 3.3. Constructed vacuum forming pattern is checked to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- selecting appropriate timber or epoxy resin to suit the vacuum forming process
- laying out the vacuum forming pattern or mould
- checking patterns and moulds
- calculating contraction rates
- checking for conformance to specifications
- measuring components to specified tolerances
- conceptualising and determining type of model required to meet specifications
- using required hand and hand held power tools

### Required knowledge

Look for evidence that confirms knowledge of:

- timber and epoxy resin product knowledge including features, characteristics and applications
- vacuum forming techniques
- tooling required for manufacture of vacuum forming patterns and moulds
- the formulae and calculations/formulae required to manufacture patterns and moulds i.e. contraction, taper
- techniques, tools and equipment to measure, mark out and produce vacuum forming patterns and moulds
- pattern checking techniques
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with developing and manufacturing vacuum forming moulds and associated equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## EVIDENCE GUIDE

Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to develop and manufacture vacuum forming moulds and associated equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and manufacturing vacuum forming patterns and moulds or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

### Guidance information for assessment

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Vacuum forming processes</b>	Vacuum forming processes include positive or negative pressure forming processes
<b>Material</b>	Includes timber, epoxy resins, composites, polymer, metal
<b>Calculations</b>	The determination of contraction rates as well as general engineering calculations within the scope of this unit

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Casting and moulding
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## MEM04016C Develop and manufacture precision models

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers laying out, manufacturing and finishing precision models.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies where accurate and complicated models are required to assist in the development and manufacture of production of tooling for a wide variety of processes, such as blow moulding, metal forming, vacuum forming, rotational moulding, gravity die casting, pressure die casting, low pressure die casting, complex ferrous and non-ferrous castings, plastic injection moulding, etc.</p> <p>Models may include flow models, viewing models, prototype and development models using a wide range of materials e.g. timber, metal plastic, fibreglass composites and processes. It may include the inspection/completion of items made in the stereo lithography process etc.</p> <p>Work is undertaken autonomously or in a team environment using predetermined standards of quality, safety and workshop procedures. All specifications are interpreted from complex drawings and Mylar drawings, technical sketches and/or customer requirements.</p> <p>When the programming of coordinate measurement machines and/or NC/CNC machines is required see appropriate machine programming units.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM04010B	Develop and manufacture wood patterns
	MEM04011B	Produce polymer patterns
	MEM04012B	Assemble plated patterns
	MEM04013B	Develop and manufacture polystyrene patterns
	MEM04014B	Develop and manufacture production patterns
	MEM04015B	Develop and manufacture vacuum forming moulds and associated equipment
	MEM04018B	Perform general woodworking machine operations
	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

<b>Prerequisite units</b>		
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood. 1.2. Appropriate material is selected to meet specifications.
2. Layout model	2.1. Finished model design is conceptualised and planned with reference to customer's specifications (written or verbal) for finish, quality and form, using applicable processes. 2.2. Contractions allowances, clearances, tapers etc. are calculated to establish model parameters. 2.3. Datum boards, jigs and fixtures are designed and manufactured as required.
3. Manufacture model	3.1. Sequence of manufacture, including build-up on



ELEMENT	PERFORMANCE CRITERIA
	<p>datum board, establishing datum's mark out of model and areas to be NC/CNC machined, are determined.</p> <p>3.2. Appropriate machines and machining processes are selected to shape/produce model to specifications.</p> <p>3.3. A range of hand and hand held power tools is selected and used utilising acceptable techniques and procedures to fashion/manufacture model to fine tolerances according to specifications, ensuring that surface finish is appropriate to the type of model.</p> <p>3.4. Appropriate measurement/calculations are undertaken to check specifications, including coordinate measuring and machine checking as required.</p> <p>3.5. Where necessary, all deviations or modifications to original tooling design, prints or plans, are recorded and reported consistent with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- selecting appropriate materials
- conceptualising and determining type of model required to meet specifications
- performing calculations necessary for manufacture
- developing and manufacturing datum boards, datum holes or datum faces, jigs and fixtures etc. required for accurate manufacture
- developing a planned sequence of manufacture
- identifying areas required to be accurately manufactured by NC/CNC
- selecting and operating the appropriate range of machines and machining processes for manufacturing the model accurately to size, tolerance and specifications
- using required hand and hand held power tools

**REQUIRED SKILLS AND KNOWLEDGE**

- measuring components to specified tolerances
- carrying out checking procedures for checking to the predetermined accuracy and fine tolerances
- orally reporting routine information
- recording

**Required knowledge**

Look for evidence that confirms knowledge of:

- consequences of selecting inappropriate materials
- various processes requiring models
- calculus, engineering calculations and formulae relating to developing and manufacturing precision models
- properties and uses of datum boards, datum holes or datum faces
- reasons for developing the sequence of manufacture
- the range of machines and machining processes and their operations
- the various checking procedures and devices including coordinate measuring and machine checking
- procedures for recording deviation or modification to original drawings or specifications
- hazards and control measures associated with developing and manufacturing precision models
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to develop and manufacture precision models. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and manufacturing precision models or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Material</b>	Timber, metal, plastic, fibreglass, composites etc.
<b>Processes</b>	High volume foundry tooling, injection moulding, pressure die casting etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04017B Develop and manufacture gear, conveyor screw and propeller patterns

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers laying out and manufacturing gear, conveyor screw and propeller patterns.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of patterns for all types of cast gears, conveyor screws, marine propellers etc., utilising the full range of timbers and composites, appropriate pattern making principles and techniques. Gear patterns may be segmented or any other method used to minimise timber shrinkage or warpage and to achieve the required strength. Conveyor and marine screws may be built up using predetermined thicknessed timber, either over a mandrel or a layout. Patterns may be set up on a joint board or plated for ease of moulding.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be considered.</p> <p>When assembly of plated patterns is required, Unit MEM04012B (Assemble plated patterns) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04010B	Develop and manufacture wood patterns
	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood. 1.2. Appropriate material is selected to specifications. 1.3. Moulding, cast techniques and foundry processes are applied in determining the type of pattern required.
2. Lay out pattern	2.1. Pattern parameters are calculated. 2.2. Pattern is laid out showing tapers, machining allowances, core prints and method of construction etc. to specification. 2.3. Jigs and fixtures are developed and manufactured to aid the manufacture of the pattern form as required.
3. Manufacture pattern	3.1. Materials are marked out and construction is developed to meet specifications. 3.2. Pattern or pattern component parts are produced to size and shape and checked for compliance with specifications using acceptable wood pattern making techniques, procedures and utilising appropriate hand and hand held power tools. 3.3. Pattern component parts are joined or fixed as required, according to specifications, using acceptable pattern making techniques and procedures. 3.4. Pattern is correctly marked, colour-coded and/or tagged in compliance with specifications or standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- determining job requirements from written instructions, standard operating procedures, sketches, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- selecting appropriate materials to suit the moulding/casting techniques and foundry process
- laying out the pattern/core boxes
- constructing patterns/core boxes
- joining and fixing component parts
- checking patterns
- calculating contraction rates/pitch/proportions/profiles
- undertaking relevant engineering calculations

### Required knowledge

Look for evidence that confirms knowledge of:

- timber, epoxy resin and composite product knowledge including features, characteristics and applications
- moulding and casting techniques for cast gears, conveyor screws and marine propellers
- tooling required for casting/moulding
- methoding techniques
- the use and application of jigs and fixtures
- methods of construction
- techniques, tools and equipment to measure, mark out&produce gear, conveyor screw&propeller patterns
- mathematical calculations and formulae required to manufacture patterns/core boxes - contraction, taper, pitch, profiles, clearances, machining allowances
- identification coding and numbering
- pattern checking techniques
- mouldability i.e. surface finish, face taper, convex or concave perspectives, undercuts, etc.
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with developing and manufacturing gear, conveyor screw and propeller patterns



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to develop and manufacture gear, conveyor screw and propeller patterns. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with manufacturing gear, conveyor screw and propeller patterns or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Material</b>	Hardwood, softwood, epoxy resins, composites
<b>Pattern parameters</b>	Pitch circles, pressure angles, tooth form, left and right hand flight helix, pitch axial dimensions, angles, tapers, clearances, contraction allowances appropriate to developing various types of gear, conveyor and propeller forms
<b>Calculated</b>	The determination of contraction rates, pitch, proportions, profiles as well as general engineering calculations

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04018B Perform general woodworking machine operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up and operating wood working machines used by engineering pattern makers and marine fabricators.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to setting up and using woodworking machines for engineering pattern making and marine vessel manufacture.</p> <p>This unit does not cover the use of woodworking machines for furniture and building construction.</p> <p>For hand held/power tools, Unit MEM18002B (Use power tools/hand held operations) should be selected.</p> <p>If the interpretation of technical drawings is required Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job instructions and specifications are interpreted and understood. 1.2.Appropriate woodworking machine is selected to meet specifications.
2. Set up woodworking machines	2.1.Tools/cutters are selected appropriate to task requirements. 2.2.Cutting tools are sharpened and/or shaped to specification. 2.3.Tools/cutters are correctly installed using standard operating procedures. 2.4.Guards/stops are set and adjusted as required.
3. Operate woodworking	3.1.Material to be machined is positioned and secured effectively.

ELEMENT	PERFORMANCE CRITERIA
machines	3.2.Materials are machined to specification using standard operating procedures. 3.3.Material use is optimised and waste is minimised.
4. Check finished component	4.1.Machined component is checked against specifications and predetermined finish.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining job requirements from job instructions, specifications, standard operating procedures and other applicable reference documents
- checking and clarifying task-related information
- selecting and setting machines
- setting guards and stops
- handling, machining and storing timber and wood
- measuring materials and components to specified sizes/tolerances
- checking for conformance to specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- application and use of general wood working machines
- interpreting instructions, drawings or sketches
- numerical operations and calculations within the scope of this unit
- machine settings including installation of blades and cutters, clamping for the job, including adjustments for sizing and speed
- the range of tools/cutters for different purposes
- the consequences of incorrect set or cutting angles
- the consequences of tool holders, tools and cutters etc., being incorrectly secured
- the consequences of not using guards etc.
- timber product knowledge including features, characteristics and applications
- methods of optimising quality of appearance, retention of shape, strength, and the minimisation of waste

**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with general woodworking machine operations

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to set up and operate wood working machines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing general woodworking machine operations or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be

**EVIDENCE GUIDE**

	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Job requirements</b>	Sizing, appearance in terms of figure, grain or surface finish, allowance of imperfections such as twist, bow, bend, sloping grain, knots, shakes, gum veins etc.
<b>Woodworking machines</b>	Band saws, buzzers, thicknesses, disk sander, bobbin sander, pattern mill, wood lathe, pedestal router and drill
<b>Set up</b>	Installation of the blades and cutters, settings for the job, including adjustments for sizing and speed
<b>Cutting tools</b>	Blades, router bits
<b>Guards/stops</b>	Fixed and variable guards and stops



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Casting and moulding
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## MEM04019B Perform refractory installation and repair

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers repairing and installing/replacing refractory.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the repair and replacement of all types of refractory, including relining furnaces, treatment vessels, ladles and launders, and covers material which can be machine rammed, hand rammed, forked or vibrated.</p> <p>This includes refractory bricks and their replacement.</p> <p>For operational maintenance such as routine repair/repointing of refractory see Units MEM04001B (Operate melting furnaces) and/or Unit MEM04007B (Pour molten metal).</p> <p>Further refractory skills are covered by Manufactured Mineral Products Training Package PMC03.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect refractory	1.1.Specification is interpreted and understood. 1.2.Specific areas of the refractory are identified for repair or replacement.
2. Knock out refractory	2.1.Sequence of operations to remove refractory is determined to meet the job specification. 2.2.Appropriate tools and equipment are selected to safely remove damaged refractory. 2.3.Damaged refractory is removed and disposed of safely.
3. Prepare refractory	3.1.Appropriate refractory materials are selected to meet

ELEMENT	PERFORMANCE CRITERIA
materials	specifications. 3.2.Refractory media is mixed to specification.
4. Install refractory	4.1.Sequence of operations to install refractory is determined to meet the job specification. 4.2.Refractory is installed using appropriate techniques and tools and equipment to meet the job specification.
5. Cure refractory	5.1.Refractory is cured to specifications using appropriate techniques and equipment to meet the job specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting job specifications and other applicable reference documents
- planning and sequencing operations
- inspecting and identifying faults
- removing damaged refractory safely
- mixing refractory correctly
- installing refractory correctly
- curing refractory correctly
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- repair or replacement requirements
- inspection techniques
- mixing, installing and curing techniques and equipment
- OH&S legislation and EPA regulations applying to working with refractory
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with refractory installation and repair

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to repair and install/replace of all types of refractory. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with to repair and install/replace of all types of refractory or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

EVIDENCE GUIDE	
	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Refractory</b>	The heat insulating material used inside molten metal vessels and includes material which can be machine rammed, hand rammed, forked or vibrated including refractory bricks, fibreboard
<b>Installed</b>	Hand ramming, machine ramming, internal and external vibration

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04020A Supervise individual ferrous melting and casting operation

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills and knowledge required to technically supervise an individual ferrous melting and casting operation in a foundry to ensure specifications are met and safety procedures maintained.
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### Application of the Unit

<b>Application of the unit</b>	<p>In a typical scenario, a foundry tradesperson will be required to monitor a ferrous melting and casting operation including tasks undertaken by other employees to ensure that correct quantities and temperatures are used, correct procedures are followed and product specifications achieved.</p> <p>The unit covers advanced trade skills and knowledge in ferrous melting and casting to enable the foundry tradesperson to act as a first line resource to other employees engaged in ferrous melting and casting. Work is performed under the overall direction of a metallurgist.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM04001B	Operate melting furnaces
	MEM04004B	Prepare and mix sand for metal moulding
	MEM04005C	Produce moulds and cores by hand (jobbing)
	MEM04007B	Pour molten metal
	MEM09002B	Interpret technical drawing
	MEM13004B	Work safely with molten metals/glass
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Identify specifications for required casting	1.1. Identify required material specification 1.2. Identify mould requirements 1.3. Identify any special melting and casting requirements for the job 1.4. Identify safety procedures for the required melting and casting operation 1.5. Identify and follow regulations and codes of practice relevant to foundry and individual melting, pouring and casting operation
2. Verify metal charges to melting	2.1. Select required components to give the required metal specification 2.2. Calculate required charge of each component 2.3. Recommend changes/additions to the charge 2.4. Monitor the preparation of the charge including checking for contaminants
3. Monitor furnace operation	3.1. Check that the furnace is in good operational condition and that appropriate lining is present 3.2. Organise for maintenance/repairs as required 3.3. Identify metal or alloy specification for required casting 3.4. Monitor a melt to ensure the product meets specification
4. Monitor pouring of molten metal	4.1. Check pouring area is secure and that all non-essential personnel are excluded 4.2. Check all members of pouring crew are wearing appropriate and in good condition personal protective equipment 4.3. Ensure escape routes are known in advance by all members of the pouring crew 4.4. Check emergency pour out pit is operational and other safety measures are in place 4.5. Ensure moulds are ready to receive liquid metal, ensure access ways and pouring ways are clear, and that there are appropriate spaces between each mould 4.6. Check pouring is undertaken at correct temperature and in efficient order 4.7. Ensure pouring basin and moulds are ready to receive liquid metal 4.8. Take required samples for analysis
5. Control hazards	5.1. Identify hazards in the metal melting/pouring

ELEMENT	PERFORMANCE CRITERIA
	process 5.2. Assess the risks arising from those hazards 5.3. Implement procedures to control those hazards in line with procedures and duty of care

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- taking calculations needed for determining charges
- performing visual checks of furnaces for operational condition and safety risks
- taking samples
- following safety and quality procedures

#### Required knowledge

Required knowledge includes:

- charge calculations:
  - importance of composition control
  - methods used to calculate for additions
  - types of alloy additions and their effects on casting behaviour and finished product
- steel:
  - induction furnace melting, principles, refractories suitable for steelmaking and their characteristics
  - arc furnace melting; acid, basic, single slag, double slag, deoxidisation and hydrogen control
  - ladle refining
- cast iron:
  - types of cast iron
  - influence of carbon and silicon contents
  - carbon equivalent
  - effect of cooling rate
  - microstructure and classification of graphite

**REQUIRED SKILLS AND KNOWLEDGE**

- carbide stabilisers and graphite
- inoculation and types of inoculant
- spheroidal graphite formation and treatment methods
- casting characteristics of grey, S.G (ductile) and malleable cast irons
- ferrous alloys:
  - definitions of ferrous metals
  - the grades of iron and their applications, including S.G. iron, ductile iron, grey and white irons, alloy cast irons, chilled and malleable iron
  - the grades of steel and their applications including carbon steel and alloy steels
  - methods of controlling physical properties
  - advantages/disadvantages of density of each type of ferrous metal
  - methods of controlling tensile strength of ferrous metals
  - methods of controlling the hardness of ferrous metals
  - the influence of melting points on production processes
  - the shrinkage percentage of the types of ferrous metals
  - how to control metal fluidity
  - the use of degassing to control gas defects
  - be able to take action to control grain size
  - casting temperature
  - make a selection of ferrous metal based on required properties
  - conduct metal analysis on ferrous metal
  - use Australian standards (or other appropriate standard) for ferrous metals
- types of furnaces and their relative advantages and disadvantages:
  - blast furnace
  - cupola
  - induction
  - direct arc
  - indirect arc
  - open hearth
  - reverberatory
  - rotary
  - maintenance
- refractory types and purposes including:
  - dolomite
  - silica brick
  - chrome brick
  - ganister
  - fireclay

**REQUIRED SKILLS AND KNOWLEDGE**

- firebrick
- magnesite
- kyanite
- fused alumina
- linings types and purposes including:
  - monolithic
  - castable
  - rammable
  - bricks
  - basic
  - acid
  - neutral
- types of ladles:
  - lip
  - tea pot
  - bottom pour
- safe working with ladles:
  - pre-heat ladles
  - ladle maintenance
  - check mechanical condition of ladles including gearboxes and safety locks
- use of lifting and handling equipment including:
  - tongs
  - shanks
  - cranes
  - hoists
  - bogey ladles
  - maintenance
- supervision of other staff in melting and casting safety including:
  - housekeeping
  - personal protective clothing
  - dry area and tools
  - pre-heating of ladles
  - safe working load of overhead cranes
- furnace operation procedures including:
  - ensuring a dry and safe charge
  - warm and dry equipment
  - pre-heating
  - scrap selection

**REQUIRED SKILLS AND KNOWLEDGE**

- housekeeping
- melting schedule
- pouring schedule
- calculations including volume and mass calculations
- charge calculations
- maintaining supply
- maintenance of melting and pouring equipment
- types of control equipment:
  - thermal analysis
  - pyrometers
  - gas analysis
  - chemical analysis
  - wet chemical analysis
  - spectrograph
  - fluidity test
- quality control and procedures for:
  - accurate weighing
  - correct chemical analysis
  - covers and fluxes
  - mould/metal reactions
  - conduct and interpretation of thermal analysis
  - alloying procedure
  - thermal analysis
  - degassing
  - deoxidising
  - ladle refining
  - chill/wedge test
  - customer requirements
- types of defects and prevention including but not limited to:
  - contamination
  - gas absorption
  - metal analysis
  - temperature control
  - oxidation
  - other defects common to iron and steel
- tapping and pouring operations including:
  - when to pour according to job and furnace specification
  - availability of emergency pour out pits and other safety equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- availability of cranes or other transport
- pour out rate
- ensure mechanical test bar is available and taken if required
- ensure pig pouring and tagging is performed correctly

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

Evidence should be provided from a number of castings using different alloys and/or different moulds.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors should ensure that candidates can competently and consistently:

- monitor the melting and casting of ferrous metal
- safely operate a melting furnace and monitor and supervise the operation of a furnace by other employees
- safely handle pouring equipment and monitor and supervise the operation of pouring equipment by other employees.

**Context of and specific resources for assessment**

Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.

Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	<p>Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.</p> <p>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</p> <p>Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</p> <p>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <p>Assessment may be in conjunction with assessment of other units of competency where required.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used</p>



RANGE STATEMENT	
<b>Contaminants</b>	Contaminants include: non-specified metal, rubber, grease, water, paint and non-metallics, closed containers or pipes and pressure containers such as aerosols
<b>Material specification</b>	Material specification includes: ferrous metals and ferrous alloys as well as contaminants

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM04021A Supervise individual non ferrous melting and casting operation

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	
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### Application of the Unit

Application of the unit	<p>In a typical scenario, a technician will be required to monitor a non-ferrous melting and casting operation including tasks undertaken by other employees to ensure that correct quantities are used, correct procedures are followed and product specifications achieved.</p> <p>The unit covers advanced trade skills and knowledge in non-ferrous melting and casting to enable the foundry tradesperson to act as a first line resource to other employees engaged in non-ferrous melting and casting. Work is performed under the overall direction of a metallurgist.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units	
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Prerequisite units		
Path 1	MEM04001B	Operate melting furnaces
	MEM04004B	Prepare and mix sand for metal moulding
	MEM04005C	Produce moulds and cores by hand (jobbing)
	MEM04007B	Pour molten metal
	MEM09002B	Interpret technical drawing
	MEM13004B	Work safely with molten metals/glass
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify specifications for	1.1. Identify required material specification 1.2. Identify mould requirements

ELEMENT	PERFORMANCE CRITERIA
required casting	1.3. Identify any special melting and casting requirements for the job 1.4. Identify safety procedures for the required melting and casting operation 1.5. Identify and follow regulations and codes of practice relevant to foundry and individual melting, pouring and casting operation
2. Verify metal charges to melting	2.1. Select required components to give the required metal specification 2.2. Calculate required charge of each component 2.3. Select required components to give the required metal specification 2.4. Recommend changes/additions to the charge 2.5. Monitor the preparation of the charge including checking for contaminants
3. Monitor furnace operation	3.1. Check that the furnace is in good operational condition and that appropriate lining is present 3.2. Organise for maintenance/repairs as required 3.3. Identify metal or alloy specification for required casting 3.4. Monitor a melt to ensure the product meets specification
4. Monitor pouring of molten metal	4.1. Check pouring area is secure and that all non-essential personnel are excluded 4.2. Check all members of pouring crew are wearing appropriate and in good condition personal protective equipment 4.3. Ensure escape routes are known in advance by all members of the pouring crew 4.4. Check emergency pour out pit is operational and other safety measures are in place 4.5. Ensure moulds are ready to receive liquid metal, ensure access ways and pouring ways are clear, and that there are appropriate spaces between each mould 4.6. Check pouring is undertaken at correct temperature and in efficient order 4.7. Ensure pouring basin and moulds are ready to receive liquid metal 4.8. Take required samples for analysis
5. Control hazards	5.1. Identify hazards in the metal melting/pouring

ELEMENT	PERFORMANCE CRITERIA
	process 5.2. Assess the risks arising from those hazards 5.3. Implement procedures to control those hazards in line with procedures and duty of care

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- taking calculations needed for determining charges
- visually checking furnaces for operational condition and safety risks
- taking samples
- following safety and quality procedures

#### Required knowledge

Required knowledge includes:

- charge calculations:
  - importance of composition control
  - methods used to calculate for additions
  - types of alloy additions and their effects on casting behaviour and finished product
- non-ferrous alloys:
  - definition of non-ferrous metals
  - methods of controlling physical properties
  - advantages/disadvantages of density of each type of non-ferrous metal
  - methods of controlling tensile strength of non-ferrous metals
  - methods of controlling the hardness of non-ferrous metals
  - influence of melting points on production processes
  - shrinkage percentage of the types of non-ferrous metals
  - how to control metal fluidity
  - be able to make a refractory selection for non-ferrous alloys
  - the use of degassing to control gas defects

**REQUIRED SKILLS AND KNOWLEDGE**

- be able to take action to control grain size
- the grades of brass and their applications
- the grades of bronze and their applications
- the grades of gunmetal and their applications
- the grades of other copper based alloys and their applications
- the grades of aluminium based alloys and their applications
- the grades of lead based alloys and their applications
- the grades of zinc based alloys and their applications
- the grades of magnesium based alloys and their applications
- make a selection of non-ferrous metal based on required properties
- conduct metal analysis on non-ferrous metals
- use Australian standards (or other appropriate standard) for non-ferrous metals
- types of furnaces and their relative advantages and disadvantages:
  - crucible
  - oil
  - gas
  - induction
  - channel
  - coreless
  - resistance
  - reverberatory
  - maintenance
- selection of appropriate refractories for non-ferrous melting:
  - silica
  - ganister
  - coatings
  - others common to non-ferrous melting
- selection of the form of linings for non-ferrous melting:
  - monolithic
  - castable
  - rammable
  - bricks
- selection of the appropriate ladles/crucibles with regard to:
  - types
  - ladles
  - crucibles
  - safety
  - maintenance including checking of mechanical condition of gearboxes and

**REQUIRED SKILLS AND KNOWLEDGE**

- safety locks
- care of crucibles
- porous plug
- supervision of other staff in melting and casting safety including:
  - housekeeping
  - personal protective clothing
  - dry area and tools
  - pre-heating of ladles
  - safe working load of overhead cranes
- furnace operation including procedures for:
  - ensuring a dry and safe charge
  - warm and dry equipment
  - pre-heating
  - scrap selection
  - scrap segregation
  - housekeeping
  - melting schedule
  - pouring schedule
  - charge calculations
  - calculations including volume and mass calculations
  - maintenance of melting and pouring equipment
- use of lifting and handling equipment including:
  - tongs
  - shanks
  - cranes
  - hoists
  - bogey ladles
  - maintenance
- types of control equipment:
  - thermal analysis
  - pyrometers
  - gas analysis
  - chemical analysis
  - wet chemical analysis
  - spectrograph
  - fluidity test
  - shrinkage test
- quality control and procedures for:

**REQUIRED SKILLS AND KNOWLEDGE**

- accurate weighing
- correct chemical analysis
- temperature control
- covers and fluxes
- mould/metal reactions
- conduct and interpretation of thermal analysis
- degassing
- deoxidising
- ladle refining
- customer requirements
- types of defects and prevention including but not limited to:
  - contamination
  - gas absorption
  - metal analysis
  - temperature control
  - oxidation
  - other defects common to non-ferrous metals
- tapping and pouring operations including:
  - when to pour according to job and furnace specification
  - availability of emergency pour out pits and other safety equipment
  - availability of cranes or other transport
  - pour out rate
  - ensure mechanical test bar is available and taken if required
  - ensure pig pouring and tagging is performed correctly

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

Evidence should be provided from a number of castings using different alloys and/or different moulds.

**Critical aspects for assessment and**

Assessors should ensure that candidates can competently



<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	<p>and consistently:</p> <ul style="list-style-type: none"> <li>• monitor melting and casting operations of non-ferrous metal</li> <li>• safely operate a melting furnace and monitor and supervise the operation of a furnace by other employees</li> <li>• safely handle pouring equipment and monitor and supervise the operation of pouring equipment by other employees.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<p>Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.</p> <p>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</p> <p>Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</p> <p>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <p>Assessment may be in conjunction with assessment of</p>

EVIDENCE GUIDE	
	other units of competency where required.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used
<b>Moulds</b>	Moulds may include sand, die and investment moulds
<b>Contaminants</b>	Contaminants include: non-specified metal, rubber, grease, water, paint and non-metallics, closed containers or pipes and pressure containers such as aerosols
<b>Material specification</b>	Material specification includes non-ferrous metals and non-ferrous alloys as well as contaminants

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Casting and moulding
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## MEM04022A Examine appropriateness of methoding for mould design

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills and knowledge required to examine the methoding (gating, running and feeding of castings) for mould designs using basic metallurgical techniques and skills.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to a foundry tradesperson who has to examine the appropriateness of own or others methoding for a mould design using basic metallurgical skills and techniques supported by normal empirical trade skills. Work is performed under the general supervision of a metallurgist.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MSATCM304A	Interpret basic binary phase diagrams

Prerequisite units		
	MEM04005C	Produce moulds and cores by hand (jobbing)
	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify specification requirements for required casting	1.1. Obtain all relevant job requirements and design specifications in accordance with workplace procedures 1.2. Identify and interpret drawing requirements and specifications
2. Evaluate proposed mould design for methoding requirements	2.1. Identify desired solidification process taking into account casting design, metal composition, mould design and specifications 2.2. Identify running, gating and feeding principles and techniques appropriate for the particular casting 2.3. Examine suitability of methoding if already selected

ELEMENT	PERFORMANCE CRITERIA
	<p>including gating and the number, placement and sizing of feeders/risers</p> <p>2.4. Where required, enter data to facilitate the generation of a computer simulation of methoding and casting process for later comparison to actual casting</p>
3. Report results	<p>3.1. Determine reporting requirements</p> <p>3.2. Prepare reports in accordance with standard operating requirements</p> <p>3.3. Circulate and file report to procedures</p> <p>3.4. Communicate suggestions for improvements directly to other team members where appropriate</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- applying scientific principles to foundry mould design
- examining mould designs using basic metallurgical skills and techniques to suit specific applications
- calculating mould runner and feeding systems
- selecting appropriate techniques and associated software and hardware technologies to suit specific applications in foundry mould design
- presenting methoding solution and any associated limitations to mould design referring to the original aim of the application and any relevant instructions from metallurgist

#### Required knowledge

Required knowledge includes:

- ability to perform calculations related to methoding and feeding including:
  - measuring dimensions of runner systems
  - calculating cross-sectional areas of sprue, runners and ingates
  - volumes and dimensions of feeders
- the effects on solidification of:

**REQUIRED SKILLS AND KNOWLEDGE**

- nucleation
- growth mechanisms (crystal and interfacial)
- dendrite coherency
- constitutional undercooling
- superheat - effects, control and minimisation of excess heat
- eutectic and peritectic solidification
- grain structure
- the principles underpinning the effective operation of running, gating and feeding systems including:
  - runner and gating principles (ratios)
  - determining type and placement of sprue, runners and ingates
  - inclusion control (slag and erosion)
  - calculations and effect of metal flow (lamellar and turbulent), velocity and temperature
  - calculation of feeder size
  - principles used in the determination of the location of feeders (end and feed zones, neighbourhood effect and feeding distances) including effect on solidification
  - exothermic and insulating feeding aids (sleeves and topping)
  - feeding mechanisms (liquid, mass, interdendritic, burst and solid)
  - use of computer packages (runner and feeder calculations and mould simulations) including benefits and limitations
  - yield calculations
- risk management strategies to minimise defect formation and the methods for minimising:
  - shrinkage
  - porosity
  - segregation
  - hot tearing
  - shear

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	Evidence should be provided from the evaluation of a number of moulds. Evidence must be provided of manual calculations and compared to computer program results.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors should ensure that candidates can competently and consistently:</p> <ul style="list-style-type: none"> <li>• calculate manually and by use of computer programs runner and feeding systems for casting designs within defined design parameters</li> <li>• examine mould designs for suitability against job specifications</li> <li>• understand the interplay between moulds, cores, gating and feeding</li> <li>• examine the resulting casting for success of gating and feeding</li> <li>• compare casting results with computer simulated predictions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<p>Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.</p> <p>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and</p>



<b>EVIDENCE GUIDE</b>	
	<p>application.</p> <p>Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</p> <p>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <p>Assessment may be in conjunction with assessment of other units of competency where required.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice and/or Australian/international standards, it is expected that the latest version will be used
<b>Size and number of feeder heads and gating</b>	Calculation of the size of feeder heads and gating includes manual calculation and use of computer programs within defined design parameters

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Casting and moulding
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## MEM04023A Undertake prescribed tests on foundry related materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills and knowledge required to carry out prescribed chemical analysis and mechanical (destructive) tests on foundry related materials and compare the results against predetermined specifications. It also includes the conducting of optical emission spectroscopy (OES) testing, but not the conducting of any other tests.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to a foundry tradesperson who is required to select and conduct an appropriate chemical, mechanical or OES test from a prescribed range of possible tests. Tests are conducted on samples of materials commonly used in foundries with results being compared against specifications for the material or product. The foundry tradesperson may be required to draw some conclusions from the results of the specified tests in regard to whether an adjustment is required within their skills and knowledge to casting or melting procedures or whether to consult on the results with a metallurgist or other authority according to standard procedures. Work would be conducted under the general supervision of a metallurgist.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select appropriate testing procedures/standards	1.1. Identify the need (or otherwise) for testing 1.2. Identify the relevant test and testing standard from prescribed range of tests and testing standards 1.3. Arrange for external testing if appropriate 1.4. Identify appropriate and certified laboratory/test equipment

ELEMENT	PERFORMANCE CRITERIA
	1.5. Select appropriate procedures/standards for the requirements of the test 1.6. Prepare sample according to appropriate procedures
2. Undertake prescribed tests	2.1. Check that sample or casting has been prepared as required by test method 2.2. Prepare sample or casting 2.3. Prepare instrument as required by procedures 2.4. Test sample or casting 2.5. Record and check test results 2.6. Repeat test results if required
3. Arrange other tests	3.1. Identify need for test 3.2. Arrange for internal or external test according to standard enterprise procedures
4. Report result of tests	4.1. Identify reporting requirements 4.2. Source externally conducted test results from provider 4.3. Determine implications of test results for process or product 4.4. Undertake or recommend actions to be taken based on test results and enterprise procedures 4.5. Prepare and circulate report in accordance with enterprise requirements

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- analysing data
- selecting and setting up appropriate tests
- solving problems
- performing tests
- interpreting results

## REQUIRED SKILLS AND KNOWLEDGE

- reporting results

### Required knowledge

Required knowledge includes:

- standards:
  - needs for standards
  - standards organisations
  - structure and operations of Standards Australia (SA)
- role of National Association of Testing Australia (NATA):
  - tensile testing
  - methods for tensile testing e.g. AS 1391 or equivalent international standard
  - determination of tensile properties
- general impact testing:
  - factors affecting impact properties of materials
  - impact testing (AS 1544) or equivalent international standard
  - dropweight tear test (AS 1330) or equivalent international standard
- hardness testing:
  - Vickers Hardness Testing (AS 1817, Part 1) or equivalent international standard
  - Brinell Hardness Testing (AS 1816, Part 1) or equivalent international standard
  - Rockwell Hardness Testing (AS 1815, Part1) or equivalent international standard
  - other hardness testing methods (e.g. Equotip and other rebound methods)
- the principles of operation, uses and limitations of optical emission spectroscopy (OES) otherwise known as atomic emission spectroscopy (AES)
- the purpose and scope of the following tests to the level required to determine the suitability or otherwise of the test but not to the level of conducting the test or interpreting the test:
  - fatigue/flex testing
  - creep testing
  - strain test and measurement
  - static shear and bend test
  - ultraviolet-visible (UV-VIS) spectrophotometry
  - infrared spectroscopy (IR)
  - gas chromatography (GC)
  - X-ray fluorescence (XRF)
  - flame photometry
  - atomic absorption spectrometry (AAS)
  - scanning electron microscopy (SEM)

**REQUIRED SKILLS AND KNOWLEDGE**

- mathematics relevant to the collation and reporting of test data
- the impact of chemical composition on the foundry process and product
- the potential implications of the variety of adjustments that could be made in response to test results

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

This competency requires evidence of competency in the selection of appropriate test methods from a prescribed range of tests for various scenarios and the interpretation of test results against predetermined specifications and standards. The scenarios, materials and test results should be relevant to the foundry industry and may be drawn directly from the workplace or may be simulated case studies.

Tests may be conducted in either a workplace or suitable laboratory facility.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors should ensure that candidates can competently and consistently:

- select appropriate test methods
- obtain repeatable results
- interpret test results for a foundry
- successfully complete several scenarios requiring the selection of different tests
- obtain reproducible test results from testing across different samples requiring different sample preparation/test conditions.

**Context of and specific resources for assessment**

Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.

Where applicable, reasonable adjustment must be made

<b>EVIDENCE GUIDE</b>	
	<p>to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<p>Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.</p> <p>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</p> <p>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</p> <p>Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</p> <p>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <p>Assessment may be in conjunction with assessment of other units of competency where required.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating</p>



<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Standards and industry codes of practice</b>	Where reference is made to industry codes of practice and/or Australian/international standards, it is expected that the latest version will be used
<b>Prescribed range of tests</b>	<p>Prescribed range of tests means tests that may be conducted by the foundry tradesperson and where the need for the test has been determined by a metallurgist or other authority according to the procedures of the enterprise and the requirements for the casting and mould materials being used and the product being cast. The prescribed range of tests may include:</p> <ul style="list-style-type: none"> <li>• OES</li> <li>• tensile/compression testing which may include testing for tensile strength, compressive strength, elongation, reduction of area, yield stress, yield point, proof stress, Young's modulus, elastic/plastic region and deformation or viscoelastic deformation</li> <li>• hardness testing - Vickers, Brinell, Rockwell and Durometer tests</li> <li>• impact testing including Izod, Charpy and Dropweight Tear</li> </ul>
<b>Other tests</b>	<p>Other tests include</p> <ul style="list-style-type: none"> <li>• fatigue/flex testing</li> <li>• creep testing</li> <li>• strain test and measurement</li> <li>• static shear and bend test</li> <li>• UV-VIS spectrophotometry</li> <li>• infrared spectroscopy (IR)</li> <li>• gas chromatography (GC)</li> <li>• X-ray fluorescence (XRF)</li> <li>• flame photometry</li> <li>• atomic absorption spectrometry (AAS)</li> <li>• scanning electron microscopy (SEM)</li> </ul>
<b>Prepare sample</b>	<p>Prepare sample means that:</p> <ul style="list-style-type: none"> <li>• representative sub-samples have been taken</li> <li>• samples are ground and milled</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>the sample is ready for the test</li> </ul>
<b>Prepare instrument</b>	Prepare instrument includes: <ul style="list-style-type: none"> <li>checking calibration</li> <li>ensuring the availability of required consumables</li> <li>curve generation where OES test is required</li> <li>setting machine conditions</li> <li>checking machine function</li> </ul>
<b>Materials</b>	Materials for mechanical tests include metals, polymer based materials and other solid materials on which mechanical testing is relevant

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Casting and moulding
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## MEM05001B Perform manual soldering/desoldering - electrical/electronic components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing manual soldering/desoldering for the installation and fabrication of electrical/electronic components.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work is undertaken in a production or maintenance environment using predetermined standards of quality, safety and work procedures. Component protection procedures are predetermined.</p> <p>Depending on the actual soldering job, hand and power tools and measuring skills may be required. These are covered by other units such as Unit MEM18001C (Use hand tools), Unit MEM18002B (Use power tools/hand held operations) and appropriate measurement units.</p> <p>This unit does not include skills in silver soldering or brazing skills. These skills are covered in Unit MEM05006B (Perform brazing and/or silver soldering).</p> <p>Where soldering and desoldering is limited to the straightforward termination, disconnection or reconnection of electrical wiring then see Unit MEM10002B (Terminate and connect electrical wiring).</p> <p>Advanced specification and high reliability soldering associated with the installation of electrical/electronic components, in areas where reliability of connections is critical, is covered by Unit MEM05002B (Perform high reliability soldering and desoldering).</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for soldering	1.1. Materials preparation instructions are followed. 1.2. Materials are prepared using correct tools, equipment, materials and procedures.

ELEMENT	PERFORMANCE CRITERIA
	1.3. Materials are prepared to specifications using instruction or standard operating procedures.
2. Solder materials	<p>2.1. Correct soldering techniques, procedures, materials and soldering tools are selected.</p> <p>2.2. Materials to be jointed, mounted, shaped are to specification using standard operating procedures.</p> <p>2.3. Solder is applied using correct and appropriate techniques.</p> <p>2.4. Where appropriate, excess material is removed using correct tools and techniques.</p> <p>2.5. Procedures for the protection of components are observed according to standard operating procedures.</p>
3. Inspect solder joints	<p>3.1. Inspection procedure is undertaken to standard operating procedures.</p> <p>3.2. Inspection results are reported/recorded to standard operating procedures as required.</p>
4. Undertake desoldering	<p>4.1. Correct and appropriate techniques, procedures, desoldering tools and equipment are selected for given task.</p> <p>4.2. Materials/components are desoldered using correct procedure and minimising damage to materials/components.</p> <p>4.3. Material/components are removed and cleaned to specifications using standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing routine soldering
- performing desoldering
- undertaking material preparation
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• following oral instruction</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• cleaning solutions and properties and cleaning procedures</li> <li>• use and application of personal protective equipment for manual soldering/desoldering</li> <li>• safe work practices and procedures</li> <li>• methods of joint preparation</li> <li>• properties of fluxes and their uses</li> <li>• heat and damage protection procedures</li> <li>• procedures for preventing electrostatic discharge damage</li> <li>• soldered joint testing and inspection procedures</li> <li>• reworking procedures and precautions</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to perform manual soldering/desoldering of electrical/electronic components.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working</p>

<b>EVIDENCE GUIDE</b>	
	<p>alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with manual soldering/desoldering for the installation and fabrication of electrical/ electronic components or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Materials</b>	Solder (solid, resin core and paste), flux (resin or powder) etc.
<b>Instructions</b>	Verbal or written job sheet

<b>RANGE STATEMENT</b>	
<b>Tools</b>	Soldering irons, cutters, brushes, files, soldering tips, solder syringes, holding devices etc.
<b>Inspection procedures</b>	Visual, mechanical or electric techniques with pre-setup equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05002B Perform high reliability soldering and desoldering

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers soldering/desoldering for the installation and fabrication of electrical/electronic components to advanced or military specifications, or where the reliability of electrical connections is critical and where prevention of damage through electrostatic discharge or other means is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit has limited application and should be confined to work undertaken on equipment where continuous performance is critical and this may include work to military specifications.</p> <p>It covers the soldering of electronic components where prevention of damage through electrostatic discharge or other means is required.</p> <p>This unit can also cover the soldering of electronic Surface Mount Devices (SMD).</p> <p>Work is undertaken in a workshop, laboratory or in situ.</p> <p>All materials and procedures are determined from specifications, manufacturers' data sheets, standard operating procedures or in consultation with a technical expert.</p> <p>All work is undertaken to legislative and regulatory requirements.</p> <p>Precision electro-measurement is covered by other unit/s.</p> <p>Hand and power tools and drawing interpretation skills may be required. These are covered by Unit MEM18001C (Use hand tools), Unit MEM18002B (Use power tools/hand held operations) and Unit MEM09002B (Interpret technical drawing).</p>
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	<p>Manual soldering for the installation and fabrication of electrical/electronic components, where reliability of connections is not critical, is covered by Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Job specification is determined using data sheets, specifications, technical drawings or via consultation with technical experts.</p> <p>1.2.Correct and appropriate tools, equipment and material are selected.</p>
2. Prepare for soldering	<p>2.1.Material/device is cut, shaped and/or drilled to specification.</p> <p>2.2.Materials/devices are cleaned to specifications using correct and appropriate materials and procedures.</p> <p>2.3.Correct and appropriate set-up and/or mounting techniques are used.</p>
3. Solder materials	<p>3.1.Material/device is mounted to specifications using correct and appropriate tools and techniques.</p> <p>3.2.Soldering is undertaken using correct and appropriate techniques including appropriate use of flux.</p> <p>3.3.Necessary techniques are undertaken to protect materials/devices from heat damage.</p> <p>3.4.Printed circuit boards, assemblies and components are handled in such a way as to prevent electrostatic discharge or mechanical damage.</p>
4. Test/inspect soldered joints	<p>4.1.Visual inspection is carried out to ensure compliance with specifications.</p> <p>4.2.Where required, mechanical/electrical tests are undertaken using correct and appropriate techniques and equipment to ensure compliance with specifications.</p>
5. Rework/repair faulty joints including desoldering	<p>5.1.Rework/repair is carried out to ensure compliance with specifications.</p> <p>5.2.Repair/rework is inspected and tested.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- performing joint preparation
- performing high level soldering
- undertaking testing/inspecting
- performing reworking/repairing
- recording
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction

### Required knowledge

Look for evidence that confirms knowledge of:

- cleaning solutions and properties and cleaning procedures
- methods of joint preparation
- properties of fluxes and their uses
- heat and damage protection procedures
- procedures for preventing electrostatic discharge damage
- soldered joint testing and inspection procedures
- reworking procedures and precautions
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to solder/desolder for the installation and fabrication of electrical/electronic components to advanced or military specifications, or where the reliability of electrical connections is critical and where prevention of damage through electrostatic discharge or

<b>EVIDENCE GUIDE</b>	
	other means is required. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing high reliability soldering and desoldering or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Tools</b>	All types of irons, pliers, side cutters, brushes, files, soldering tips, solder syringes, holding devices etc.
<b>Materials</b>	Solder (solid, resin cord and paste), flux (resin or powder) etc.
<b>Device</b>	Medical/navigation equipment etc.
<b>Test/inspection</b>	Visual, mechanical or electrical techniques

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05003B Perform soft soldering

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit applies to performing soft soldering applications of ferrous and non-ferrous materials, using straightforward techniques, where heat damage to components or finish of soldered joint is not critical.
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### Application of the Unit

<b>Application of the unit</b>	<p>All work is undertaken to predetermined standards of quality, safety and procedures.</p> <p>Techniques of applying soft solder may include the use of soldering irons (all types) and direct flame or other heating devices. Preparation of materials includes cleaning, deburring, twisting of conductors and fluxing.</p> <p>Depending on the actual soldering job, hand and power tools and drawing and interpretation skills may be required. These are covered by units MEM18001C (Use hand tools), MEM18002B (Use power tools/hand held operations) and MEM12023A (Perform engineering measurements).</p> <p>This unit should not be selected if Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components) or Unit MEM10002B (Terminate and connect electrical wiring) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirements	1.1.Soldering requirements are identified and correctly understood from job sheets or instructions.
2. Undertake soft soldering	2.1.Tools, equipment and consumables appropriate to the task are assembled and prepared for use as required. 2.2.Materials to be soldered are prepared, arranged and checked as required, to ensure solder joint meets specifications.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.3. Correct techniques are used to apply soft solder to standard operating procedures.</p> <p>2.4. Solder joint is cleaned and checked for conformance to specifications using standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using soldering irons
- using direct flame and other heating devices
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction

#### Required knowledge

Look for evidence that confirms knowledge of:

- the effect of material to be soft soldered on the selection of consumables
- the reasons for preparing surfaces prior to soldering
- the procedures for rectifying defects in soldered joints
- use and application of personal protective equipment for soft soldering
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform soft soldering.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with performing soft soldering or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Tools</b>	Soldering irons (all types) and direct flame or other heating devices
<b>Materials</b>	Ferrous and non-ferrous

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05004C Perform routine oxy acetylene welding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials and performing routine oxy acetylene welding.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in a maintenance or manufacturing environment where the welding is not required to meet an Australian standard or equivalent. Fillet and butt welds would typically be performed on low carbon/mild steels.</p> <p>Where welding is required to meet Australian Standard 1554 General Purpose or equivalent codes, OHS regulations and/or licensing requirements, Unit MEM05022C (Perform advanced welding using oxy acetylene process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify weld requirements	1.1.Weld requirements are identified from job instructions. 1.2.Location of welds is identified in accordance with standard operating procedures and job specifications.
2. Prepare materials for welding	2.1.Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1.Welding equipment is set up correctly. 3.2.Settings and consumables are selected.
4. Perform routine welding using <i>oxy acetylene</i>	4.1.Safe welding practices are applied. 4.2.Materials are welded to job requirements. 4.3.Welds are cleaned in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials
- setting up welding equipment
- welding with oxy acetylene fuel gas
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instructions
- using measurement skills for joint preparation and routine oxy acetylene welding

#### Required knowledge

Look for evidence that confirms knowledge of:

- preparatory requirements
- materials and consumables properties and characteristics
- equipment and equipment settings
- fuel gas properties and applications
- post welding treatments
- weld characteristics
- any applicable industry standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- safe work practices and procedures
- safe welding practices
- use and application of personal protective equipment for routine oxy acetylene welding

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare materials and carry out routine oxy acetylene welding.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing routine oxy acetylene welding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Materials</b>	Mild and low carbon steel and cast iron
<b>Prepared</b>	Preheating, setting up jigs, fixtures, clamps, joint preparation
<b>Equipment</b>	Hoses, blowpipes, regulators
<b>Consumables</b>	Filler rods, fluxes
<b>Oxy acetylene</b>	The term 'oxy-acetylene' is used here to describe a range of fuel gases, including acetylene, LPG, hydrogen etc.
<b>Cleaned</b>	Fluxes

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Fabrication
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## MEM05005B Carry out mechanical cutting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up and operating a range of mechanical cutting and holing equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to sawing, shearing, cropping and/or holing and includes setting up and operating a range of equipment. Examples of machines that could be covered include guillotines, croppers, cold saws, band saws, automatic saws etc. Typical applications of this unit may include cutting for manufacture, production cutting and cutting of materials selected from stores in a maintenance environment.</p> <p>This unit does not cover hand or hand held power tools used for cutting e.g. circular saws, nibblers and side grinder. These skills are covered by Unit MEM18001C (Use hand tools) and Unit MEM18002B (Use power tools/hand held operations).</p> <p>This unit does not include the skills required for operational maintenance of the equipment used; these skills are covered by Unit MEM07001B (Perform operational maintenance of machines/equipment).</p> <p>For repair and welding of band saw blades where blade repair unit is not attached to the machine, refer to Unit MEM05013C (Perform manual production welding).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job requirements and specifications are determined from job sheets and/or instructions. 1.2.Appropriate method/machine is selected to meet specifications. 1.3.Machine is loaded and adjusted for operation consistent with standard operating procedures.
2. Select/set up machine tooling	2.1.Tooling is selected to match job requirements. 2.2.Tooling is correctly installed using standard

ELEMENT	PERFORMANCE CRITERIA
	<p>operating procedures.</p> <p>2.3.Machine is set up and adjusted using standard operating procedures.</p>
3. Operate mechanical cutting machine	<p>3.1.Appropriate stops and guards are set and adjusted as required.</p> <p>3.2.Material is secured and correctly positioned using measuring equipment as necessary.</p> <p>3.3.Machine is started and stopped safely to standard operating procedures.</p> <p>3.4.Machine is operated to cut/hole material to specifications using standard operating procedures.</p>
4. Check material for conformance to specification	<p>4.1.Material is checked against specification. Machine and/or tooling is adjusted as required and in process adjustments carried out as necessary.</p> <p>4.2.Material is cut and/or holed to within workplace tolerances.</p> <p>4.3.Material is used in most economical way.</p> <p>4.4.Codes and standards are observed.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- loading and adjusting cutting machines
- selecting machines and tooling
- installing cutting tool
- setting up and adjusting cutting machine
- securing and correctly positioning materials
- cutting and holing materials
- applying relevant codes and standards
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction
- measuring materials to specified workplace tolerances and within the machine

**REQUIRED SKILLS AND KNOWLEDGE**

range

- clarifying routine task-related information

**Required knowledge**

Look for evidence that confirms knowledge of:

- the characteristics of cutting methods and machines
- effect of materials on the machine tooling, tooling defects and adjustments
- effect of adjustments on the dimensions of the cut material
- applicable tolerances
- methods of marking out materials to ensure minimum wastage
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standard
- use and application of personal protective equipment for mechanical cutting
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to carry out mechanical cutting on a range of machines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

**EVIDENCE GUIDE**

	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with carrying out mechanical cutting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Machine</b>	Guillotines, croppers, cold saws, band saws, automatic saws etc.
<b>Tooling</b>	Tooling to suit guillotines, croppers, cold saws, band saws, automatic saws etc.

<b>RANGE STATEMENT</b>	
<b>Stops and guards</b>	All safety equipment/stops/guards on guillotines, croppers, cold saws, band saws, automatic saws etc.
<b>Material</b>	Ferrous and non-ferrous metals and non-metallic products
<b>Codes and standards</b>	Legislative and regulatory requirements, industry and enterprise codes and standards

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05007C Perform manual heating and thermal cutting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing manual heating, thermal cutting and gouging including the assembly and disassembly and operation of the equipment on a range of materials (ferrous, non-ferrous and non-metallic) using a variety of methods.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to manual, straight line cutting standards. Manual or automatic processes are used to cut and heat to specifications. Cutting may include flame gouging by hand. All work is carried out to legislative and regulatory requirements. Predetermined standards of quality and safety are observed and work is carried out following standard operating procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Assemble/disassemble plant and equipment	1.1. Accessories and equipment are correctly selected and assembled for manual heating and thermal cutting.
2. Operate heating and thermal cutting equipment	2.1. Cutting process and/or procedure appropriate for material is selected. 2.2. All safety procedures are observed. 2.3. Equipment start-up procedures are followed correctly to standard operating procedures. 2.4. Equipment adjustments are made correctly using standard operating procedures. 2.5. Appropriate cutting allowances are made. 2.6. Material is used in the most economical way. 2.7. Defects are identified and corrective action is taken to standard operating procedures. 2.8. Material is heated and cut to specification.

ELEMENT	PERFORMANCE CRITERIA
	2.9.Shape/size/length is to accepted workplace standards.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing pre-start checks
- safely starting equipment
- following standard operating procedures
- adjusting equipment to operating specifications
- making cutting allowances
- economising material and minimising wastage
- identifying cutting defects and taking corrective action
- heating and cutting materials to specifications
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- performing measurements needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- cutting processes appropriate to various materials
- heating and cutting specifications
- procedures for heating and cutting
- the tools, equipment and techniques for heating and cutting
- assembling procedures for equipment and accessories
- hazards and control measures associated with manual heating and thermal cutting
- use and application of personal protective clothing and equipment
- equipment pre-checks and operation
- procedures for adjusting heating and cutting equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- cutting allowances and reasons for applying them
- procedures for minimising waste material
- reasons for minimising waste material
- cutting defects and their causes
- procedures for correcting cutting defects
- tools, equipment and techniques required to correct cutting defects
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform manual heating and thermal cutting.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with manual heating/thermal cutting or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questions should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Cutting**

Use of hand held and self-propelled straight line cutters

**Process**

Fuel gas, oxy fuel gas and air fuel gas

**Material**

Various thicknesses and types including ferrous, non-ferrous and non-metallic materials

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05006C Perform brazing and or silver soldering

### Modification History

Corrections to descriptor and range to clarify inclusion of 'brazing welding'.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing brazing (including brazing welding) and silver soldering. It includes the preparation of materials and equipment and the inspection of the completed work.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to silver soldering and brazing using all grades of silver solder and braze. It also includes soldering of copper and refrigeration work. Work includes the preparation of materials and equipment and the inspection of the completed work.</p> <p>Work is undertaken in a production or maintenance environment using predetermined standards of quality, safety and work procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare materials and equipment	1.1.Job requirements are determined from specifications and/ or instructions. 1.2.Materials are correctly prepared using appropriate tools and techniques. 1.3.Materials are correctly assembled/aligned to meet specifications as required. 1.4.Distortion prevention measures are identified and appropriate action is taken as required. 1.5.Heating equipment is assembled and set up safely and correctly in accordance with standard operating procedures. 1.6.Correct and appropriate consumables are selected and prepared. 1.7.Test run is undertaken and verified as required.
2. Braze and/or silver	2.1.The correct process is selected to meet specifications.



ELEMENT	PERFORMANCE CRITERIA
solder	2.2.Materials are preheated as required. 2.3.Consumables are applied using correct techniques. 2.4.Jointing material is applied correctly and in appropriate quantities to meet job/specifications. 2.5.Material temperature is annealed using correct and appropriate techniques.
3. Inspect joints	3.1.Excess jointing materials are removed using correct and appropriate techniques. 3.2.Inspection of joints is undertaken to standard operating procedures. 3.3.Inspection results are reported/recorded using standard operating procedures as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials
- performing brazing, braze welding, silver soldering
- undertaking visual inspection
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- the reasons for selecting specific methods of assembly/alignment
- the procedures for minimising distortion of the materials being brazed/braze welded/silver soldered
- the procedures for assembling and setting up the specific heating equipment
- the reasons for selecting specific heating equipment
- the reasons for selecting specific consumables
- conducting test runs

**REQUIRED SKILLS AND KNOWLEDGE**

- typical applications of brazing/braze welding and silver soldering processes
- the procedures and precautions for preheating the materials to be joined
- the effects of the use of inappropriate techniques on the performance of the jointed materials
- the effect of inappropriate quantities of jointing material on the performance of the jointed materials
- the procedures for normalising the temperature of jointed materials
- the consequences of using inappropriate techniques to normalise the temperature of the joint
- the procedures for removing excess jointing material
- the procedures for inspecting brazed/braze welded/silver soldered joints
- use and application of personal protective equipment for silver soldering and brazing/braze welding
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform brazing (including braze welding) and silver soldering.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the

<b>EVIDENCE GUIDE</b>	
	<p>candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with brazing (including braze welding) and/or silver soldering or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Materials</b>	Ferrous and non-ferrous
<b>Heating</b>	Oxy acetylene and fuel gas, cylinders, connections, hoses, tips and nozzles
<b>Consumables</b>	Fluxes (resin or powder), all types of silver solder and brazing grades, etc.

**RANGE STATEMENT**

<b>Process</b>	Brazing, braze welding and silver soldering
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05008C Perform advanced manual thermal cutting, gouging and shaping

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing manual heating, thermal cutting and gouging to produce complex internal and external profiles. It includes the assembly/disassembly of plant and equipment, selection of settings and consumables and operation of the equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manual thermal cutting process used to produce complex internal and external profiles which satisfy predetermined shape, size and surface finish specifications.</p> <p>Items are cut, shaped or gouged by a variety of methods which may include oxy acetylene, oxy/hydrogen, plasma, carbon arc, etc. Predetermined standards of quality and safety are observed and work is carried out following standard operating procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assemble/disassemble plant, equipment for manual thermal cutting, gouging and shaping	1.1.Appropriate cutting process and procedure for material being worked are selected. 1.2.Accessories and equipment are correctly selected and assembled.
2. Select equipment settings and consumables	2.1.Correct equipment settings and consumables are selected from standard operating procedures.
3. Operate hand held thermal cutting and shaping equipment	3.1.All safety procedures are observed. 3.2.Equipment start-up procedures are followed correctly to standard operating procedures. 3.3.Material is cut to specification with

ELEMENT	PERFORMANCE CRITERIA
	<p>shape/profile/surface finish to accepted workplace standards.</p> <p>3.4.Cutting defects are identified and corrective action is taken to standard operating procedures.</p> <p>3.5.Material is removed with minimum loss of sound metal.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, interpreting and following relevant job sheets, drawings, instructions and procedures
- selecting and assembling equipment and accessories
- following safety procedures
- safely checking, starting and operating equipment
- cutting material to specifications
- identifying and correcting cutting defects
- economising material and minimising waste

#### Required knowledge

Look for evidence that confirms knowledge of:

- cutting processes and procedures appropriate to various material
- heating and cutting specifications
- procedures for heating and cutting
- specifications for cutting and surface finish
- use and applications of tools, equipment and techniques for heating and cutting
- assembling procedures for equipment and accessories
- equipment settings
- application of various consumables
- sources of information on equipment settings and consumables
- hazards and control measures associated with manual heating and thermal cutting
- use and application of personal protective clothing and equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- equipment pre-checks and operation
- procedures for adjusting heating and cutting equipment
- cutting allowances and reasons for applying them
- procedures for minimising waste material
- reasons for minimising waste material
- cutting defects and their causes
- procedures for correcting cutting defects
- tools, equipment and techniques required to correct cutting defects
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform advanced manual thermal cutting, gouging and shaping. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,



<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with advanced manual thermal cutting, gouging and shaping or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	

## RANGE STATEMENT


## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05009C Perform automated thermal cutting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up and using single and multi-headed automated thermal cutting machines.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to setting up and operating automated thermal cutting machines used in heavy engineering for plate and pipe cutting on automated single or multi-head machines. Cutting media would include fuel gases, oxy acetylene, plasma arc, laser etc. Powder marking and magnetic, photoelectric tracing devices or numerically controlled (NC) machines may be used.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Set up material	1.1. Material is set up, including correct procedures for stack cutting and nesting to minimise waste.
2. Set up and use automated cutting machine	2.1. Appropriate cutting medium is selected and set to specification. 2.2. Process requirements are determined from specifications or instructions. 2.3. Machine is set up safely to specifications using standard operating procedures. 2.4. Correct program is selected and loaded to standard operating procedure. 2.5. Machine datum are established to specifications.
3. Use automated thermal cutting machine	3.1. Where required, cutting medium is ignited following standard operating procedures. 3.2. Machine is started using correct sequence and procedure. 3.3. Powder marking and other tracing devices are used as required to standard operating procedures. 3.4. Correct shut-down procedure is observed in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting up materials and machines
- using thermal cutting machines
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction

#### Required knowledge

Look for evidence that confirms knowledge of:

- material set-up procedures.
- advantages of stack cutting and nesting
- procedures for establishing machine datum
- hazards associated with igniting cutting media
- safety precautions to be taken when starting and shutting down the machine.
- procedures for using powder marking and other tracing devices.
- use and application of personal protective equipment for automated thermal cutting
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to set up and use single and multi-headed automated thermal cutting machines. Competency in this unit cannot be claimed until all prerequisites have been

<b>EVIDENCE GUIDE</b>	
	satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing automated thermal cutting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Material</b>	Ferrous and non-ferrous
<b>Cutting medium</b>	Includes fuel gases, oxy acetylene, plasma arc, laser etc.
<b>Machine</b>	Single or multi-headed machines including NC driven equipment etc.
<b>Correct program</b>	Programs on numerically controlled (NC) machines are selected and loaded according to predetermined instructions
<b>Tracing devices</b>	Powder marking and magnetic, photoelectric tracing devices

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Fabrication
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## MEM05010C Apply fabrication, forming and shaping techniques

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers applying fabrication, forming and shaping of a wide variety of shapes and products undertaken by an Engineering Tradesperson - Fabrication using a variety of forming and shaping techniques. The fabrication, forming and shaping is done to specifications interpreted from technical drawings and job specifications using a variety of tools and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to fabrication, forming and shaping of plate, sheet and tubular ferrous and non-ferrous metal to specified measurements, tolerances and shapes. Skills covered by this unit are generally applied in occupational and work situations associated with steel fabrication, boilermaking or sheet metal work.</p> <p>This unit has been developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in fabrication, forming and shaping.</p> <p>Predetermined standards of quality and safety are observed and work is carried out following standard operating procedures.</p> <p>This unit includes the ability to produce a wide range of shapes and products such as pipework, chamfers, cylinders, cones, angles, hoppers, ductwork, 'square to round', 'transitions', 'lobster backs' and all forms of tubular shapes, including hand rails, reticulation pipework and mufflers.</p> <p>Materials may include ferrous and non-ferrous and non-metallic materials. A variety of tools and equipment may be used including presses, shapers, benders, rollers</p>
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	<p>and drop hammers.</p> <p>If heating or thermal cutting is required, MEM05007C Perform manual heating and thermal cutting should be accessed.</p> <p>Where marking off/out skills are required, then MEM12007D Mark off/out structural fabrications and shapes should be selected. Where welding is required, relevant welding units should be selected.</p> <p>This unit does not cover repetitive fabrication, bending and shaping of metal and non-metallic materials by production workers, trades assistants etc. such as where the bending or shaping equipment has been pre-set and the material to be fabricated, formed or shaped has been pre-marked up or pre-cut to size. This unit is also not intended to apply in situations where products or shapes are merely bent using hand tools or equipment.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05037C	Perform geometric development
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select and set up forming/shaping equipment for a specific operation	1.1. Most appropriate tools and equipment are selected 1.2. Equipment is correctly set up and adjusted for operation to standard operating procedures 1.3. Allowances for shrinkage, thickness and inside/outside measurements are correctly made
2. Operate forming/shaping equipment	2.1. Machine is safely started up and shut down to standard operating procedures 2.2. Material and safety guards are correctly positioned. 2.3. Equipment is correctly operated and adjusted
3. Form and shape material	3.1. Material is levelled, straightened, rolled, pressed or bent to specifications/drawings using fabrication techniques 3.2. Correct hot or cold forming procedures are followed 3.3. Final form/shape is checked for compliance to specification and adjusted as necessary to standard operating procedures

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- selecting tools and equipment
- setting up and adjusting equipment
- calculating allowances
- taking measurements
- starting up and shutting down the machine
- positioning material
- positioning safety guards
- obtaining drawings and/or specifications
- selecting the most appropriate forming/shaping process to achieve the required size and specification
- forming/shaping material to size and specification
- checking the final form/shape of the object for conformance with specifications
- reworking the object to ensure conformance with specifications
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information

#### Required knowledge

Required knowledge includes:

- variety of hot and cold forming/shaping processes
- machines, tools and/or equipment required to perform forming/shaping processes
- reasons for selecting chosen tools, equipment and processes
- adjustments that can be made to the equipment and the effect of adjustments on the object being formed/shaped
- allowances when forming/shaping materials
- sources of data relating to allowances
- startup and shutdown procedures
- the material positioning/feeding requirements
- the location and function of all safety guards
- procedures for the forming/shaping process
- defects in formed/shaped materials
- defects that can be rectified by further work/adjustment

**REQUIRED SKILLS AND KNOWLEDGE**

- hazards and control measures associated with undertaking fabrication, forming and shaping, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to apply fabrication, forming and shaping techniques to meet specifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- examining drawings and specifications to determine correct equipment to be used and sequence of fabrication, forming and shaping processes
- correctly identifying any specified tolerances
- correctly calculating allowances for shrinkage, thickness and inside/outside measurements
- setting up and safely operating equipment to ensure forming and shaping outcome is to specifications
- ensuring equipment is shut down and made safe
- carrying out hot and cold forming processes safely and to specifications including levelling, straightening, rolling, pressing or bending.

**Context of and specific resources for assessment**

This unit has been developed to support training in and recognition of trade level competency in fabrication, forming and shaping as applied to a sheet metal or metal fabrication environment. Assessment should emphasise a workplace context and procedures found in the

<b>EVIDENCE GUIDE</b>	
	<p>candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Fabrication work are required to exercise fabrication, forming and shaping skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying fabrication, forming and shaping techniques or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Tools and equipment</b>	<p>Tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• presses</li> <li>• shapers</li> <li>• benders</li> <li>• rollers</li> <li>• drop hammers</li> </ul>
<b>Material</b>	<p>Material may include ferrous and non-ferrous and non-metallic substances</p>
<b>Fabrication techniques</b>	<p>Fabrication techniques may include measurements and calculations associated with allowances for shrinkage, thickness and inside/outside measurements</p>
<b>Final form/shape</b>	<p>Final form/shape may include:</p> <ul style="list-style-type: none"> <li>• pipework</li> <li>• chamfers</li> <li>• cylinders</li> <li>• cones</li> <li>• angles</li> <li>• hoppers</li> <li>• ductwork</li> <li>• 'square to round'</li> <li>• 'transitions'</li> <li>• 'lobster backs'</li> <li>• all forms of tubular shapes, including hand rails, reticulation pipework and mufflers</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05011D Assemble fabricated components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the assembly of general fabricated components in plate, pipe and section or sheet either on-site or in a typical fabrication workplace by an Engineering Tradesperson - Fabrication. Assembly is performed according to specifications or drawings. The unit covers trade level assembly techniques requiring the use of jigs, fixtures and tools.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to assembly of ferrous and non-ferrous fabrications to specifications including use of joining techniques. Skills covered by this unit are generally applied in occupational and work situations associated with steel fabrication, boilermaking or sheet metal work.</p> <p>This unit has been developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade skills in assembly of fabricated components.</p> <p>Typical applications are transitions, pipeworks and structural fabrication, ductwork, general jobbing work, fired and unfired pressure vessels.</p> <p>Work may be undertaken in plant or on-site, and as part of a team in many instances in cooperation with those with rigging/dogging skills where necessary.</p> <p>This unit does not cover the skills for the assembly of fabricated engineering components. These skills are covered by MEM18006C Repair and fit engineering components.</p> <p>Assembly using pre-constructed jigs is covered by MEM03001B Perform manual production assembly or</p>
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	<p>MEM03003B Perform sheet and plate assembly.</p> <p>Where welds are required to meet legislative or regulatory requirements, then appropriate welding units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 2</b>	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and

Prerequisite units		
		thermal cutting
	MEM05019D	Weld using gas tungsten arc welding process
	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 3</b>	MEM05004C	Perform routine oxy acetylene welding
	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05022C	Perform advanced welding using oxy acetylene welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 4</b>	MEM05005B	Carry out mechanical cutting

Prerequisite units		
	MEM05007C	Perform manual heating and thermal cutting
	MEM05017D	Weld using gas metal arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify assembly method and construct jigs if required	1.1.Method is identified and jigs are constructed from engineering drawings or according to workshop practice 1.2.Distortion prevention/control techniques are correctly applied
2. Ensure all components for assembly are available	2.1.All components are checked against drawings and material list
3. Select tools and fixtures for fabrication assembly	3.1.Most appropriate equipment is selected
4. Assemble fabricated components	4.1.Material and/or fabricated components are correctly positioned 4.2.Jigs, fixtures, tools and measuring equipment are correctly adjusted and applied 4.3.Datum line is correctly determined if necessary 4.4.Assembled components are checked for position including squareness, level and alignment to specification 4.5.Fixing/joining techniques are applied as necessary according to standard operating procedures 4.6.Assembly is checked for compliance with drawing 4.7.Codes/standards are interpreted and applied

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- constructing jigs where appropriate
- applying distortion prevention/control techniques
- positioning components in accordance with drawing/specifications

**REQUIRED SKILLS AND KNOWLEDGE**

- using jigs, fixtures, tools and equipment
- correctly marking the datum line
- checking the position of all assembled components visually and dimensionally
- using appropriate fixing/joining techniques

**Required knowledge**

Required knowledge includes:

- methods for assembly of fabricated components
- jigs construction
- effects of distortion of fabricated components
- distortion prevention techniques
- drawing and material list
- characteristics of relevant tools and equipment squareness, level and alignment
- function of datum lines
- variety of fixing/joining techniques
- defects associated with the assembly of fabricated components
- methods of rectification of defects by rework or adjustment
- requirements of relevant codes/standards

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to safely assemble general fabricated components in plate, pipe and section or sheet to specifications and drawings using accepted engineering trade techniques, practices, processes and workplace procedures. Competency in this unit cannot be awarded until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence

<b>EVIDENCE GUIDE</b>	
	<p>include:</p> <ul style="list-style-type: none"> <li>• planning assembly tasks and sequences</li> <li>• determining and implementing appropriate distortion control techniques</li> <li>• assembling general fabricated components in plate, pipe, section or sheet to specifications, codes, occupational health and safety (OHS) regulations and standard operating procedures</li> <li>• demonstrating safe working practices at all times</li> <li>• ability to assemble components in a workshop and site environment</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency in assembly of fabricated components as applied to a sheet metal or metal fabrication environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit can be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Fabrication work are required to use their fabricated assembly skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate</p>

**EVIDENCE GUIDE**

	must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the assembly of fabricated components or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Distortion prevention/control techniques</b>	<p>Distortion prevention/control techniques may include:</p> <ul style="list-style-type: none"> <li>• jigs</li> <li>• fixtures</li> <li>• heat</li> <li>• clamps</li> </ul>
<b>Components</b>	Components may include general fabricated components in either plate, pipe and section or sheet
<b>Alignment</b>	Alignment may include typical structural alignment and levelling using planes and line straight edges, spirit levels, line levels and



RANGE STATEMENT	
	squares
<b>Fixing/joining techniques</b>	Fixing/joining techniques may include: <ul style="list-style-type: none"> <li>• welding</li> <li>• adhesives</li> <li>• fasteners</li> <li>• rivets</li> </ul>
<b>Codes/standards</b>	All work carried out in accordance with legislative and regulatory requirements

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05012C Perform routine manual metal arc welding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing the materials and carrying out routine manual metal arc welding (MMAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in a maintenance or manufacturing environment where the welding is not required to meet an Australian standard or equivalent. Fillet and butt welds would typically be performed on low carbon/mild steels.</p> <p>Where welding is required to AS 1554 General Purpose or equivalent codes, occupational health and safety regulations and/or licensing requirements, Unit MEM05015D (Weld using manual metal arc welding process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify weld requirements	1.1.Weld requirements are identified from job instructions. 1.2.Location of welds is identified in accordance with standard operating procedures and job specifications.
2. Prepare materials for welding	2.1.Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1.Welding equipment is set up correctly. 3.2.Correct electrodes are selected to suit application and settings.
4. Perform routine welding using MMAW	4.1.Safe welding practices are applied. 4.2.Materials are welded to job requirements. 4.3.Welds are cleaned in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials and electrodes
- setting up welding equipment
- welding with MMAW
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- performing measurements for joint preparation and routine MMAW

#### Required knowledge

Look for evidence that confirms knowledge of:

- material and equipment preparation
- properties and characteristics of materials and consumables
- weld characteristics
- equipment set-up and settings
- MMAW processes and properties
- post-welding treatments
- safe welding practices
- use and application of personal protective equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare materials and carry out routine manual metal arc welding (MMAW).

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing routine manual metal arc welding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Materials</b>	Low and mild carbon steel or similar
<b>Prepared</b>	Cleaning, setting up jigs, fixtures, clamps, joint preparation
<b>Welding equipment</b>	Welding leads, welding machines, electrode holder etc.
<b>Cleaned</b>	Slag and spatter, cleaning, using files and grinders

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05013C Perform manual production welding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing tacking or production welding, including spot welding using a range of methods and metallic and non-metallic materials in a production environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welding undertaken in the production environment. Guidance may be required with respect to equipment settings, choice of consumables, gas mixture and pressures.</p> <p>For performing automated/production welding, Unit MEM07024B (Operate and monitor machine/process) or Unit MEM07025B (Perform advanced machine/process operation) should be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Tack and/or weld material using appropriate welding process	<p>1.1. Material is prepared for the process to be used following standard operating procedures.</p> <p>1.2. Material is aligned (if required) using dedicated jigs and fixtures.</p> <p>1.3. Welding is carried out to accepted workplace standards.</p>

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.



<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<b>Required skills</b>
<p>Look for evidence that confirms skills in:</p> <ul style="list-style-type: none"> <li>aligning to jigs and fixtures</li> <li>welding within the scope of this unit</li> <li>following standard operating procedures</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>function and use of jigs and fixtures in production welding</li> <li>hazards associated with the welding process used</li> <li>function, application and operation of welding equipment within the scope of this unit</li> <li>material preparation</li> <li>acceptable workplace standards</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to perform tacking or production welding, including spot welding using a range of methods and metallic and non-metallic materials in a production environment.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must</p>

**EVIDENCE GUIDE**

	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing manual production welding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Material**

Metallic and non-metallic materials, including low carbon steels

**RANGE STATEMENT**

<b>Welding</b>	Spot, resistance, hot air, ultrasonic
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05014C Monitor quality of production welding/fabrications

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic inspection of completed or partly completed welded fabrications produced by others in a production environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency would be used in a production welding environment to monitor the quality of production fabrication work where knowledge of the welding techniques and testing procedures is required. Duties should be carried out in consultation with appropriately qualified supervisor or engineer.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc

Prerequisite units		
		welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 2</b>	MEM05017D	Weld using gas metal arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 3</b>	MEM05019D	Weld using gas tungsten arc welding process
	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

Prerequisite units		
Path 4	MEM05004C	Perform routine oxy acetylene welding
	MEM05007C	Perform manual heating and thermal cutting
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Monitor quality of welded products	1.1.Weld requirements are identified from specifications and/or drawings.

ELEMENT	PERFORMANCE CRITERIA
	1.2. Inspection procedures are carried out to standard operating procedures. 1.3. Nonconforming welds are reported and corrective action is initiated according to standard operating procedures. 1.4. Pre-set gauges are used to monitor quality of product.
2. Initiate testing when required	2.1. Test requirements are implemented according to standard operating procedures and any legislative or regulatory requirements.
3. Undertake procedures reporting	3.1. Data is collected to standard operating procedures. 3.2. Reports are prepared as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- recognising nonconforming welds
- reading, interpreting and following information on specifications, standard operating procedures, drawings and other applicable reference documents
- using pre-set gauges
- collecting weld test data
- entering routine and familiar information onto proformas and standard workplace forms/reports

#### Required knowledge

Look for evidence that confirms knowledge of:

- the function of pre-set gauges
- test requirements appropriate to the welded product
- legislative and/or regulatory requirements of the welded product
- reporting and corrective action procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to monitor the quality of completed or partly completed welded fabrications produced by others in a production environment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with monitoring the quality of production welding/fabrications or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,



**EVIDENCE GUIDE**

	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Inspection procedures</b>	Visual/gauges inspections
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Fabrication
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## MEM05015D Weld using manual metal arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the preparation, positioning, fixing, and manual welding techniques associated with general trade level welding using manual metal arc welding (MMAW) equipment including the selection and set up of the equipment appropriate to both the material and the weld to be performed, carrying out the MMAW to prescribed standards, and examining for and correcting defects, in a range of welded fabrications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to welds associated with heavy or light metal fabrications. Welds are fillet and butt welds in all positions on a range of ferrous and non-ferrous materials that may include carbon steel or stainless steel. Weld quality would conform to Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent.</p> <p>This unit has been primarily developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in MMAW. It may also apply to other trade occupations requiring higher level MMAW welding skills.</p> <p>Where manual thermal processes associated with preparation, pre-heat and/or post-heat are required, MEM05007C Perform manual heating and thermal cutting and/or MEM05008C Perform advanced manual thermal cutting, gouging and shaping should be considered for selection.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05012C	Perform routine manual metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for manual metal arc welding (MMAW)	1.1.Weld requirements are identified from specifications and/or drawings 1.2.Materials are correctly prepared 1.3.Materials are assembled/aligned to specification, where required
2. Select welding equipment and consumables	2.1.Welding equipment and electrodes appropriate to the material and the weld are identified and selected
3. Assemble and set up welding equipment	3.1.Welding equipment is assembled and set up
4. Minimise and rectify distortion	4.1.Appropriate distortion prevention measures are selected and applied 4.2.Distortion is rectified
5. Weld to job specification using MMAW	5.1.Weld deposit is to specification 5.2.Joints are cleaned to specifications
6. Ensure weld conformance	6.1.Defects are rectified with minimum loss of sound metal using correct techniques and tools 6.2.Weld joints are visually inspected for conformance to specifications
7. Where required, maintain weld records	7.1.Where required, weld records are completed correctly

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying and interpreting welding specifications including appropriate standards e.g. Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent
- selecting and using appropriate tools and equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- using a variety of welding machines and electrodes
- identifying and rectifying weld defects
- applying techniques for distortion prevention and rectification
- cleaning welds
- reading and interpreting information on sketches, written job instructions, specifications, standard operating procedures and engineering drawings
- recording routine information including routine weld records related to MMAW onto proformas and standard workplace forms
- following oral instructions
- measurement skills relating to joint preparation and MMAW

**Required knowledge**

Required knowledge includes:

- material preparation
- joint preparations
- electrode classification
- causes of distortion for materials within the scope of this unit
- causes of defects and methods of rectification
- the relationships between amperage, electrode and material
- safe welding practices
- use and application of personal protective equipment for MMAW

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out MMAW and examine for and correct defects, in a range of welding activities associated with MMAW. Competency in this unit cannot be awarded until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in

<b>EVIDENCE GUIDE</b>	
<b>competency in this unit</b>	<p>this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:</p> <ul style="list-style-type: none"> <li>• following all safety procedures to protect self, other workers and members of the public</li> <li>• identifying and interpreting specifications for MMA welding including Australian Standard 1554 General Purpose</li> <li>• interpreting welding specifications including standard welding symbols used to show weld procedure</li> <li>• selecting appropriate weld preparation methods for material and position of welds.</li> <li>• preparing materials, setting up of jigs, fixtures, clamps, etc. and joint preparation including bevelling</li> <li>• consistently welding different ferrous and non-ferrous materials to AS 1554 General Purpose or equivalent</li> <li>• identifying defects as described in the range statement across a range of welded materials</li> <li>• rectifying defects.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Welding to AS 1554 General Purpose or equivalent requires both theoretical knowledge and high level practical skills. The assessment process must be designed to identify consistent performance to the standard and the specifications across a range of materials and positions. The assessment must also identify a level of workplace performance in terms of defect rates and weld failure rates. It is recommended that assessment involve demonstrations of competency under both workshop and site conditions. This means that the ideal assessment environment is either on the job or a combination of both on and off the job.</p> <p>The competencies covered by this unit may be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically an Engineering Tradesperson - Fabrication and other tradespersons engaged in welding are required to exercise MMAW skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment</p>

**EVIDENCE GUIDE**

	<p>process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using MMAW process or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



<b>RANGE STATEMENT</b>	
<b>Welds</b>	Welds include fillet and butt welds carried out in all positions
<b>Materials</b>	Materials may include ferrous materials including carbon or stainless steel, as well as non-ferrous metals and alloys suitable for MMA welding
<b>Prepared</b>	Preparation of materials may include: <ul style="list-style-type: none"> <li>• pre-heating</li> <li>• setting up of jigs, fixtures and clamps</li> <li>• joint preparation (e.g. bevelling)</li> </ul>
<b>Equipment</b>	Equipment may include AC or DC welding machines
<b>Distortion prevention measures</b>	Distortion prevention measures may include: <ul style="list-style-type: none"> <li>• pre heating</li> <li>• setting up of jigs, fixtures and clamps</li> </ul>
<b>Rectified</b>	Rectified refers to oxy acetylene, air arc equipment and grinding devices
<b>Defects</b>	Defects may include: <ul style="list-style-type: none"> <li>• porosity</li> <li>• slag inclusions</li> <li>• discontinuities</li> <li>• lack of penetration</li> <li>• undercut</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05016C Perform advanced welding using manual metal arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out advanced manual metal arc welding (MMAW), inspecting for and correcting defects, and maintaining the weld records.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welds associated with a range of structural sections and/or plate and/or pipe for general fabrication. Weld quality would typically conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare welding materials and equipment	1.1.Welding equipment is prepared. 1.2.Welding equipment appropriate to task requirements is assembled and adjusted correctly and safely. 1.3.Materials are prepared to achieve the required weld specification.
2. Weld joints to code requirements using MMAW	2.1.Weld requirements are interpreted correctly. 2.2.Welds are deposited correctly to specifications. 2.3.Appropriate distortion prevention measures are selected for the weld type and material and distortions are rectified as required.
3. Assess weld quality and rectify faults	3.1.Weld joints are visually inspected against specifications. 3.2.Defects are removed using appropriate methods for the given task. 3.3.Weld records are correctly completed and maintained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- welding to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent
- interpreting weld requirements and specifications
- entering information onto proformas and standard workplace forms
- interpreting technical drawings and weld specifications relating to advanced MMAW
- using hand and power tools to prepare and weld material using MMAW
- using measurement and numeracy skills relating to advanced MMAW and preparation
- selecting equipment and consumables appropriate to the task
- using visual identification of faults/defects

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- in-depth knowledge of the properties and characteristics of a wide range of materials
- requirements to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent
- weld procedures and requirements
- different welder identification systems such as numbering, bar coding, paint coding, letter stamps
- safety requirements
- safe welding practices
- use and application of personal protective equipment for MMAW

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out advanced MMAW, inspect for and correct defects, and maintain the weld records. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced welding using manual metal arc welding process (MMAW), or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Welding equipment</b>	AC or DC welding machines, settings, electrodes and related equipment
<b>Materials</b>	Materials used would include low carbon, cast

<b>RANGE STATEMENT</b>	
	iron, stainless and low alloy steel
<b>Prepared</b>	Preparation of materials may include preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. bevelling
<b>Welds</b>	Welds would be fillet and butt in all positions
<b>Distortion prevention measures</b>	Distortion prevention may include preheating, setting up of jigs, fixtures, clamps, etc.
<b>Defects</b>	Porosity, slag inclusions, discontinuities, lack of penetration, undercut
<b>Appropriate methods</b>	Oxy acetylene and air arc equipment and grinding devices
<b>Weld records</b>	Proformas and other standard workplace forms

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05017D Weld using gas metal arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the preparation, positioning, fixing, and manual welding techniques associated with general trade level welding using gas metal arc welding (GMAW) equipment including the selection and set up of the equipment appropriate to both the material and the weld to be performed, carrying out the GMAW to prescribed standards, and examining for and correcting defects, in a range of welded fabrications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to welds associated with heavy or light metal fabrications. Welds are fillet and butt welds in all positions on a range of ferrous and non-ferrous materials that may include carbon steel or stainless steel. Weld quality would conform to Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent.</p> <p>This unit has been primarily developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in GMAW. It may also apply to other trade occupations requiring higher level GMAW welding skills.</p> <p>Where manual thermal processes associated with preparation, pre-heat and/or post-heat are required, MEM05007C Perform manual heating and thermal cutting and/or MEM05008C Perform advanced manual thermal cutting, gouging and shaping should be considered for selection.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for gas metal arc welding (GMAW)	1.1.Weld requirements are identified from specifications and/or drawings 1.2.Material is correctly prepared 1.3.Materials are assembled/aligned to specification where required
2. Select welding components and consumables	2.1.Welding machine settings, accessories and consumables are identified and selected
3. Assemble and set up welding equipment	3.1.Welding equipment is assembled and set up
4. Minimise and rectify distortion	4.1.Appropriate distortion prevention measures are selected and applied 4.2.Distortion is rectified
5. Weld to job specification using GMAW	5.1.Weld deposit is to specifications 5.2.Joints are cleaned to specifications
6. Ensure weld conformance	6.1.Weld joints are visually inspected for conformance to specifications 6.2.Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools
7. Maintain weld records as required	7.1.Weld records are completed correctly

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying and interpreting welding specifications including appropriate standards e.g. Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent
- selecting and using appropriate tools and equipment

## REQUIRED SKILLS AND KNOWLEDGE

- using a variety of welding machines and electrodes
- identifying and rectifying weld defects
- applying techniques for distortion prevention and rectification
- cleaning welds
- reading and interpreting information on sketches, written job instructions, specifications, standard operating procedures and engineering drawings
- recording routine information including routine weld records related to GMAW onto proformas and standard workplace forms
- following oral instructions
- measurement skills relating to joint preparation and GMAW

### Required knowledge

Required knowledge includes:

- types of gases and their uses
- the relationships between amperage/wire feed, voltage, gas flow, electrode and material
- the application of weld metal transfer (short arc, spray etc.)
- correct welding machine, leads, hand pieces and electrodes
- material preparation
- joint preparations
- electrode classification
- causes of distortion for materials within the scope of this unit
- safe welding practices
- use and application of personal protective equipment for GMAW

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out GMAW and examine for and correct defects, in a range of welding activities associated with GMAW. Competency in this unit cannot be awarded until all prerequisites have been satisfied.

**EVIDENCE GUIDE****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:

- following all safety procedures to protect self, other workers and members of the public
- identifying and interpreting specifications for GMAW including Australian Standard 1554 General Purpose
- interpreting welding specifications including standard welding symbols used to show weld procedure
- selecting appropriate weld preparation methods for material and position of welds.
- preparing materials, setting up of jigs, fixtures, clamps, etc. and joint preparation including bevelling
- consistently welding different ferrous and non-ferrous materials to AS 1554 General Purpose or equivalent
- identifying defects as described in the range statement across a range of welded materials
- rectifying defects.

**Context of and specific resources for assessment**

Welding to AS 1554 General Purpose or equivalent requires both theoretical knowledge and high level practical skills. The assessment process must be designed to identify consistent performance to the standard and the specifications across a range of materials and positions. The assessment must also identify a level of workplace performance in terms of defect rates and weld failure rates. It is recommended that assessment involve demonstrations of competency under both workshop and site conditions. This means that the ideal assessment environment is either on the job or a combination of both on and off the job.

The competencies covered by this unit may be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

**Method of assessment**

Typically an Engineering Tradesperson - Fabrication and other tradespersons engaged in welding are required to exercise GMAW skills and techniques across a range of jobs and specifications.

**EVIDENCE GUIDE**

	<p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using GMAW process or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Weld</b>	Welds include fillet and butt welds carried out in all positions
<b>Materials</b>	Materials may include ferrous materials including carbon or stainless steel, as well as non-ferrous metals and alloys suitable for GMAW
<b>Prepared</b>	Preparation of materials may include: <ul style="list-style-type: none"> <li>• pre-heating</li> <li>• setting up of jigs, fixtures and clamps</li> <li>• joint preparation (e.g. bevelling)</li> </ul>
<b>Equipment</b>	Equipment may include AC or DC welding machines
<b>Distortion prevention measures</b>	Distortion prevention measures may include: <ul style="list-style-type: none"> <li>• pre-heating</li> <li>• setting up of jigs, fixtures and clamps</li> </ul>
<b>Rectified</b>	Rectified refers to oxy acetylene, air arc equipment and grinding devices
<b>Defects</b>	Defects may include: <ul style="list-style-type: none"> <li>• porosity</li> <li>• slag inclusions</li> <li>• discontinuities</li> <li>• lack of penetration</li> <li>• undercut</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05018C Perform advanced welding using gas metal arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out advanced gas metal arc welding (GMAW), inspecting for and correcting defects, and maintaining the weld records.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welds associated with a range of structural sections and/or plate and/or pipe for general fabrication using ferrous and non-ferrous materials.</p> <p>Weld quality would typically conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05017D	Weld using gas metal arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare welding materials and equipment	1.1.Welding equipment is prepared. 1.2.Welding equipment is assembled and adjusted correctly and safely. 1.3.Materials are prepared to achieve required weld specification.
2. Weld joints to code requirements using advanced GMAW	2.1.Weld requirements are interpreted correctly. 2.2.Welds are deposited correctly to specifications. 2.3.Appropriate distortion prevention measures are selected and distortions are rectified as required.
3. Assess weld quality and rectify faults	3.1.Weld joints are visually inspected against specifications. 3.2.Defects are removed using appropriate methods for the given task.. 3.3.Weld records are correctly completed and maintained.

## Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in: <ul style="list-style-type: none"><li>• welding to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent</li><li>• performing safe welding practices</li><li>• using and applying personal protective equipment for GMAW</li><li>• interpreting weld requirements and specifications</li><li>• entering information onto proformas and standard workplace forms</li><li>• interpreting technical drawings and weld specifications relating to advanced GMAW</li><li>• using hand and power tools to prepare and weld material using GMAW</li><li>• using measurement and numeracy skills relating to advanced GMAW and preparation</li><li>• selecting equipment and consumables appropriate to the task</li></ul>

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• using visual identification of faults/defects</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• in-depth knowledge of the properties and characteristics of a wide range of materials</li> <li>• requirements to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent</li> <li>• weld procedures and requirements</li> <li>• different welder identification systems such as numbering, bar coding, paint coding, letter stamps</li> <li>• safe welding practices</li> <li>• use and application of personal protective equipment for GMAW</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out advanced GMAW, inspect for and correct defects, and maintain the weld records. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this</p>

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced welding using gas metal arc welding process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Welding equipment</b>	AC or DC welding machines, settings, electrodes and related equipment
<b>Preparing materials</b>	Preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. bevelling

<b>RANGE STATEMENT</b>	
<b>Materials</b>	Low carbon, cast iron, stainless and low alloy steel, aluminium and aluminium alloys
<b>Welds</b>	Fillet and butt in all positions
<b>Distortion prevention measures</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Defects</b>	Porosity, slag inclusions, discontinuities, lack of penetration, undercut
<b>Appropriate methods</b>	Oxy acetylene arc equipment, grinding devices
<b>Weld records</b>	Proformas and other standard workplace forms

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05019D Weld using gas tungsten arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the preparation, positioning, fixing, and welding techniques associated with general trade level welding using gas tungsten arc welding (GTAW) equipment including the selection and set up of the equipment appropriate to both the material and the weld to be performed, carrying out the GTAW to prescribed standards, and examining for and correcting defects, in a range of welded fabrications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to welds associated with heavy or light metal fabrications. Welds are fillet and butt welds in all positions on a range of ferrous and non-ferrous materials that may include carbon steel or stainless steel and aluminium. Weld quality would conform to Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS), or equivalent.</p> <p>This unit has been primarily developed to support Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in GTAW. It may also apply to other trade occupations requiring higher level GTAW welding skills.</p> <p>Where manual thermal processes associated with preparation, pre-heat and/or post-heat are required, MEM05007C Perform manual heating and thermal cutting and/or MEM05008C Perform advanced manual thermal cutting, gouging and shaping should be considered for selection.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for gas tungsten arc welding (GTAW)	1.1. Weld requirements are identified from specifications and/or drawings 1.2. Material is correctly prepared 1.3. Materials are assembled/aligned to specification, where required
2. Select welding equipment and consumables	2.1. Welding equipment and electrodes, accessories and consumables appropriate to the material are identified and selected
3. Assemble and set up welding equipment	3.1. Welding equipment is assembled and set up
4. Minimise and rectify distortion	4.1. Appropriate distortion prevention measures for weld and material type are selected and applied 4.2. Distortion is rectified
5. Weld to job specification using GTAW	5.1. Weld deposit is to specifications 5.2. Joints are cleaned to specifications
6. Ensure weld conformance	6.1. Defects are removed with minimum loss of sound metal using techniques and tools appropriate to the defect, material and process 6.2. Weld joints are visually inspected for conformance to specifications
7. Maintain weld records as required	7.1. Weld records are completed correctly

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying and interpreting welding specifications including appropriate standards e.g. Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent
- selecting and using appropriate tools and equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- using a variety of welding machines and electrodes
- identifying and rectifying weld defects
- applying techniques for distortion prevention and rectification
- cleaning welds
- reading and interpreting information on sketches, written job instructions, specifications, standard operating procedures and engineering drawings
- recording routine information including routine weld records related to GTAW onto proformas and standard workplace forms
- following oral instructions
- measurement skills relating to joint preparation and GTAW

**Required knowledge**

Required knowledge includes:

- correct welding machine, leads, hand pieces and electrodes
- material preparation
- joint preparations
- electrode classification
- causes of distortion for materials within the scope of this unit
- causes of defects and methods of rectification
- the relationships between amperage, electrode and material
- types of gases and their uses
- types of electrodes, current settings and high frequency voltage
- filler materials and consumables
- safe welding practices
- use and application of personal protective equipment for GTAW

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out the GTAW welding and examine for and correct defects, in a range of welding activities associated with GTAW. Competency in this unit cannot

<b>EVIDENCE GUIDE</b>	
	be awarded until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:</p> <ul style="list-style-type: none"> <li>• following all safety procedures to protect self, other workers and members of the public</li> <li>• identifying and interpreting specifications for GTAW including Australian Standard 1554 General Purpose</li> <li>• interpreting welding specifications including standard welding symbols used to show weld procedure</li> <li>• selecting appropriate weld preparation methods for material and position of welds.</li> <li>• preparing materials, setting up of jigs, fixtures, clamps, etc. and joint preparation including bevelling</li> <li>• consistently welding different ferrous and non-ferrous materials to AS 1554 General Purpose or equivalent</li> <li>• identifying defects as described in the range statement across a range of welded materials</li> <li>• rectifying defects.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Welding to AS 1554 General Purpose or equivalent requires both theoretical knowledge and high practical skills. The assessment process must be designed to identify consistent performance to standard and specification across a range of materials and positions. The assessment must also identify a level of workplace performance in terms of defect rate and weld failure rates. It is recommended that assessment involve demonstrations of competency under both workshop and site conditions. This means that the ideal assessment environment is either on the job or a combination of both on and off the job.</p> <p>The competencies covered by this unit may be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	Typically an Engineering Tradesperson - Fabrication and other tradespersons engaged in welding are required to exercise GTAW skills and techniques across a range of

**EVIDENCE GUIDE**

	<p>jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using GTAW process or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating

<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Prepared</b>	Prepared may include: <ul style="list-style-type: none"> <li>• pre-heating</li> <li>• setting up of jigs, fixtures and clamps</li> <li>• joint preparation (e.g. bevelling)</li> </ul>
<b>Welds</b>	Welds include fillet and butt welds carried out in all positions
<b>Materials</b>	Materials may include ferrous and non-ferrous materials including carbon steel, stainless steel, aluminium and other materials suitable for GTAW welding
<b>Welding equipment</b>	Welding equipment may include AC or DC welding machines
<b>Distortion prevention measures</b>	Distortion prevention measures may include: <ul style="list-style-type: none"> <li>• pre-heating</li> <li>• setting up of jigs, fixtures and clamps</li> </ul>
<b>Rectified</b>	Rectified may include: <ul style="list-style-type: none"> <li>• oxy acetylene and air arc equipment</li> <li>• grinding devices</li> </ul>
<b>Defects</b>	Defects may include: <ul style="list-style-type: none"> <li>• porosity</li> <li>• slag inclusions</li> <li>• discontinuities</li> <li>• lack of penetration</li> <li>• undercut</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05020C Perform advanced welding using gas tungsten arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out advanced gas tungsten arc welding (GTAW), inspecting for and correcting defects, and maintaining the weld records.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welds associated with a range of structural sections and/or plate and/or pipe for general fabrication. Weld quality would typically conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05007C	Perform manual heating and thermal cutting



Prerequisite units		
	MEM05019D	Weld using gas tungsten arc welding process
	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Prepare welding materials and equipment	1.1. Welding equipment is prepared. 1.2. Welding equipment appropriate to task requirements is assembled and adjusted correctly and safely. 1.3. Materials are prepared to achieve the required weld specification.
2. Weld joints to code requirements using advanced GTAW	2.1. Weld requirements are interpreted correctly, 2.2. Welds are deposited correctly to specifications. 2.3. Appropriate distortion prevention measures are selected for the weld type and material and distortions are rectified as required.
3. Assess weld quality and rectify faults	3.1. Weld joints are visually inspected against specifications. 3.2. Defects are removed using appropriate methods for the given task. 3.3. Weld records are correctly completed and maintained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- welding to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent
- interpreting technical drawings and weld specifications relating to advanced GTAW
- using hand and power tools to prepare and weld material using GTAW
- using measurement and numeracy skills relating to advanced GTAW and preparation
- selecting equipment and consumables appropriate to task
- using visual identification of faults/defects

#### Required knowledge

Look for evidence that confirms knowledge of:

**REQUIRED SKILLS AND KNOWLEDGE**

- in-depth knowledge of the properties and characteristics of a wide range of materials
- requirements to conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent
- weld procedures and requirements
- different welder identification systems such as numbering, bar coding, paint coding, letter stamps
- safe welding practices
- use and application of personal protective equipment for GTAW
- hazards and control measures related to GTAW

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out the GTAW welding and inspect for and correct defects and maintain welding records. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced welding using gas tungsten arc welding process (GTAW) or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment</b>	AC or DC welding machines, gases, settings, electrodes and related equipment
<b>Materials</b>	Low carbon, cast iron, stainless and low alloy steel, aluminium
<b>Prepared</b>	Preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. bevelling

<b>RANGE STATEMENT</b>	
<b>Welds</b>	Fillet and butt in all positions
<b>Distortion prevention measures</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Defects</b>	Porosity, slag inclusions, discontinuities, lack of penetration, undercut
<b>Appropriate methods</b>	Oxy acetylene, air arc equipment and grinding devices
<b>Weld records</b>	Proformas and other standard workplace forms

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Fabrication
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## MEM05022C Perform advanced welding using oxy acetylene welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing advanced oxy acetylene welding, carried out using a range of materials for general fabrication.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to comprehensive preparation as required in a range of environments. It also includes maintaining weld records and rectifying defects. The term 'oxy acetylene' is used here to describe a range of fuel gases, including acetylene, LPG, hydrogen etc.</p> <p>This unit covers the competencies required for welding quality that would meet the Australian Standard 1554 Special Purpose, appropriate industrial standards, or equivalent outcomes.</p> <p>Where welds comply with one of the certificates covered by Australian Standard 1796, then Unit MEM05026C (Apply welding principles) should also be selected.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05004C	Perform routine oxy acetylene welding
	MEM05007C	Perform manual heating and thermal cutting
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select welding equipment and consumables	1.1. Correct welding equipment and consumables are selected from weld procedure specifications.
2. Prepare welding materials and equipment	2.1. Welding equipment and consumables are prepared according to job requirements. 2.2. Welding equipment appropriate to the task is assembled and adjusted correctly and safely. 2.3. Materials are prepared to achieve required weld specification.
3. Assemble welding equipment	3.1. Welding equipment, including cylinders, regulators, hoses, torches and tips is assembled and set up safely in accordance with standard operating procedures.
4. Weld joints to Australian Standard 1554 SP or equivalent	4.1. Materials are welded to Australian Standard 1554 SP or equivalent in all positions. 4.2. Instructions, symbols, specifications are interpreted correctly including bead size, bead placement, reinforcement etc. and in accordance with weld procedure sheet, if available, and standard operating procedures.
5. Inspect welds	5.1. Weld joints are visually inspected against specifications. 5.2. Weld defects are identified.
6. Correct faults	6.1. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools to Australian Standard 3992 or equivalent.
7. Maintain weld records	7.1. Weld records are maintained in accordance with specifications and standard operating procedures.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in:



## REQUIRED SKILLS AND KNOWLEDGE

- selecting equipment and consumables
- assembling welding equipment
- welding to AS1554 SP
- inspecting welds to specification
- correcting weld faults to AS3992
- entering information on to proformas and standard workplace forms
- using hand and power tools to prepare and weld materials
- interpreting weld requirements and specifications/procedures
- using measurement and numeracy skills for advanced oxy acetylene welding
- selecting equipment and consumables appropriate to given task
- using visual identification of defects/faults

### Required knowledge

Look for evidence that confirms knowledge of:

- preparatory requirements
- the purpose and examples of pre-welding and post-welding heating of the weld materials
- the appropriate settings for the given task and the selected equipment/consumables
- the purpose of reinforcing areas to be welded
- the methods of weld defect removal and their application
- material and consumable properties and characteristics
- requirements of AS1554SP and AS3992 or equivalent
- fuel gas properties and applications
- post treatments
- recording procedures
- safe welding practices
- use and application of personal protective equipment for oxy acetylene welding
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to perform advanced oxy acetylene welding carried out using a range of materials for general fabrication. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced welding using oxy acetylene welding process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment and consumables</b>	Fuel gases, including acetylene, LPG, hydrogen etc., cylinders, regulators, hoses, torches, tips, range of filler rods and fluxes
<b>Weld</b>	Fillet and butt in the horizontal, vertical and overhead positions
<b>Preparing materials</b>	Preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. bevelling
<b>Materials</b>	Low carbon steel, plate, pipe, tube and round bar

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Fabrication
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## MEM05023C Weld using submerged arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out the submerged arc welding, inspecting for and correcting defects, and maintaining weld records.
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### Application of the Unit

<b>Application of the unit</b>	<p>Welds are more likely to be associated with heavy rather than with light fabrication. Welds include fillet and butt welds in all positions on a range of materials that may include carbon and stainless steel. The weld quality would meet the Australian Standard 1554 General Purpose or equivalent. The unit may satisfy the requirements of AS 1796 Certificate 9.</p> <p>Where welds comply with one of the certificates covered by Australian Standard 1796, then Unit MEM05026C (Apply welding principles) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for welding	1.1.Weld requirements are identified from specifications and/or drawings. 1.2.Material is correctly prepared using tools and techniques appropriate to the material and process. 1.3.Materials are assembled/aligned to specifications, where required.
2. Select welding machine settings and consumables	2.1.Welding machine settings and consumables are identified from job requirements, welding procedures and specifications and/or technical drawings.
3. Assemble and set up welding equipment	3.1.Welding equipment is assembled and set up safely and correctly to standard operating procedures. 3.2.Test runs are undertaken and verified in accordance with specifications.

ELEMENT	PERFORMANCE CRITERIA
4. Identify distortion prevention methods	4.1. Distortion prevention measures are identified. 4.2. Action appropriate to the weld type and material is taken to minimise and rectify distortion.
5. Weld joints using submerged arc by correct process	5.1. Pad, butt and fillet welds are deposited correctly in flat, and fillet welds in horizontal position, to specification. 5.2. Joints are cleaned to specifications using techniques and tools appropriate to the defect, material and process.
6. Inspect welds	6.1. Weld joints are visually inspected against specifications. 6.2. Weld defects are identified.
7. Correct faults	7.1. Remedial action is taken, where required. 7.2. Defects are removed with minimum loss of sound metal using techniques and tools appropriate to the defect, material and process.
8. Maintain weld records as required	8.1. Weld records are maintained to specifications and standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying and interpreting appropriate standard e.g. Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent
- selecting and using appropriate tools and equipment
- using a variety of welding machines, wire electrodes, settings and materials
- identifying and rectifying weld defects
- applying techniques for distortion prevention and rectification
- cleaning weld
- maintaining weld records

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- main types of fluxes and flux/wire combinations
- typical applications of SAW and common materials
- the application of weld metal transfer (short arc, spray, etc.)
- material preparation
- joint preparations
- electrode classification
- causes of distortion for materials within the scope of this unit
- causes of defects and methods of rectification
- code requirements
- safe welding practices
- use and application of personal protective equipment for submerged arc welding
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out the submerged arc welding, visually inspect for and correct defects, and maintain the weld records. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic



<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using submerged arc welding process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Weld</b>	Fillet and butt in flat and horizontal positions
<b>Prepared</b>	Preparation of materials including preheating, setting up of jigs, fixtures, clamps, etc., joint

<b>RANGE STATEMENT</b>	
	preparation e.g. bevelling
<b>Equipment</b>	DC welding machines
<b>Distortion prevention measures</b>	Distortion prevention including preheating, setting up of jigs, fixtures, clamps, etc.
<b>Defects</b>	Porosity, slag inclusions, discontinuities, lack of penetration, undercut
<b>Remedial action</b>	Remedial action using thermal processes may include oxy acetylene and air arc equipment; grinding devices may also be used

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05024B Perform welding supervision

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers instructing and qualifying welders in accordance with weld procedures, and maintaining quality and safety procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>Competencies in this unit are based on wide knowledge of welding science, processes, procedures and technical requirements. Individuals working in this field would hold at least one certificate satisfying the requirements of Australian Standard 1796 Certificate 1-9. The supervision, training and qualification of welders in welding procedures is defined by recognised codes and standards e.g. Australian Standard 2214 and Australian Standard 1796 Certificate 10.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05026C	Apply welding principles

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine and prepare welding procedure	1.1. Welders are instructed according to procedure. 1.2. Welding parameters are determined in accordance with procedures 1.3. Variables and sequence checks are planned against documentation. 1.4. Documentation is prepared for record keeping.
2. Qualify welders to required procedures	2.1. Welders are trained in relevant procedures. 2.2. Welders are tested against relevant procedures. 2.3. Welder performance reports against procedures are maintained.
3. Monitor/maintain quality assurance and safety procedures	3.1. Internal quality assurance plan is monitored. 3.2. Traceability of materials is ensured. 3.3. Welding is supervised to ensure compliance with prescribed specifications and/or documented

ELEMENT	PERFORMANCE CRITERIA
	procedures and/or safety procedures.
4. Prepare documents	<p>4.1. Procedure is recorded against pre-qualifying procedures.</p> <p>4.2. Findings on internal quality assurance plan are recorded.</p>
5. Arrange for non-destructive testing and destructive testing	<p>5.1. Weld tests appropriate to the weld procedure are arranged.</p> <p>5.2. Non-destructive testing/destructive testing reports are verified against job requirements and specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- individuals working in this field would hold at least one certificate satisfying the requirements of Australian Standard 1796 Certificate 1-9.
- welding to the procedure being supervised
- providing training to welders on welding procedures
- communicating to welders on welding requirements
- planning of weld procedures
- writing workplace welding procedures, recording information on proformas and other workplace documents/reports

#### Required knowledge

Look for evidence that confirms knowledge of:

- welding science, principles and effects of heat treatment
- welding terms, codes and symbols
- welding processes, parameters and relation to weld quality
- welding procedures defined by code and technical requirements
- non-destructive testing
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards

**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment for welding supervision
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to provide appropriate supervision to welding tasks and outcomes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, that is the candidate is not in productive work, appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying a wide knowledge of welding science, processes, procedures and technical requirements to the supervision process or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedure</b>	As defined by the relevant codes and/or standards
<b>Documentation</b>	As defined by the relevant codes and/or standards
<b>Traceability</b>	The materials used in a nominated weld can be traced to their source in accordance with standard operating procedures

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05025C Perform welding/fabrication inspection

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing welding/fabrication inspection by selecting, conducting or verifying appropriate non-destructive tests, establishing and validating welding procedures, ensuring quality assurance is carried out, and monitoring procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welding inspection based on knowledge of welding science and metallurgy, mechanical properties of welded joints, heat treatment procedures and national and technical standards. All work is undertaken in accordance with legislative and regulatory requirements. Test procedures and the range of this standard are determined by applicable Australian and/or international standards.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05026C	Apply welding principles
	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select and organise/conduct appropriate non-destructive test procedures or verify previous test procedures	1.1.Appropriate non-destructive tests are selected and organised/conducted in accordance with standard operating procedures or job specifications. 1.2.Results of previous testing procedures are verified.
2. Establish welding procedure	2.1.Joint design specification is interpreted. 2.2.Parameters are described. 2.3.Variables are checked. 2.4.Procedures are documented.
3. Validate welding procedures	3.1.Preparation of a test piece is organised. 3.2.Prescribed tests are arranged or conducted.

ELEMENT	PERFORMANCE CRITERIA
	3.3. Test results are interpreted and report is prepared identifying required action.
4. Ensure quality assurance procedures are carried out	4.1. Material identification is checked. 4.2. Movement of material through workshop in-site is documented. 4.3. Transferring material test certification numbers is witnessed. 4.4. Identification of consumables in accordance with welding procedures is performed. 4.5. Storage and use of consumables are monitored. 4.6. Quality records are maintained and reviewed to ensure compliance with requirements.
5. Monitor procedures in process	5.1. Material forming is checked. 5.2. Dimensional checks are carried out. 5.3. Final inspection is made against specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, interpreting and applying relevant job instructions, design and weld specifications, codes, standards and procedures
- organising tests
- initiating and conducting weld tests
- obtaining and interpreting weld tests
- obtaining and interpreting weld design data
- verbally conveying, checking and clarifying information
- checking weld parameters for conformance to specifications
- documenting welding procedures
- preparing test reports
- recording movement of material through the workshop
- producing test pieces
- marking consumables for identification

## REQUIRED SKILLS AND KNOWLEDGE

- checking material for conformance to specifications
- using and storing welding consumables
- maintaining welding quality records
- checking welding records for conformance with welding quality requirements
- checking the form of the material to be welded for conformance with specifications
- using measurement skills for checking the dimensions of welded components
- performing relevant calculations

## Required knowledge

Look for evidence that confirms knowledge of:

- hazards and control measures associated with welding/fabrication inspection
- safe work practices and procedures
- use and application of personal protective equipment
- types of non-destructive tests and their application
- welding procedures for the given weld
- tests/checks to be conducted
- arithmetic operations, formulae and calculations for testing welding/fabrications
- procedures for initiating the weld tests
- procedures for conducting a variety of non-destructive tests
- procedures for obtaining previous weld tests
- discrepancies between previous and current weld tests
- reasons for any identified discrepancies
- effects of testing procedures on test results
- procedures for verifying/amending previously established weld test procedures
- the parameters affecting the performance of the weld with respect to specifications
- variables affecting the performance of the weld
- tools, equipment and techniques necessary to check each variable
- procedures, tools, techniques and equipment necessary to check the form and dimensions of the welded components
- procedures for documenting welding procedures and preparing a weld test piece
- tools, equipment and techniques to carry out the prescribed tests
- procedures for initiating prescribed tests, obtaining test results, and reporting test result
- discrepancies between the test results and weld specifications
- action to be taken to return the welds produced to specification
- weld specifications
- methods of identifying weld materials
- reasons for correctly marking/identifying weld materials
- procedures for documenting/recording the movement of material through the workshop

## REQUIRED SKILLS AND KNOWLEDGE

- the reasons for documenting/recording the movement of material through the workshop
- procedures for transferring material test certification numbers
- person(s) who can witness the transfer of material test certification numbers
- the reasons for witnessing the transfer of material test certification numbers
- procedures for identifying consumables and reasons for marking consumables for identification purposes
- procedures for using and storing consumables and the consequences of inappropriate use and/or storage of consumables
- the storage life of consumables
- procedures for maintaining welding quality records
- the welding quality requirements of the relevant code, standard and/or welding procedure

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform welding/fabrication inspection. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

<b>EVIDENCE GUIDE</b>	
	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing welding/fabrication inspection or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Non-destructive tests</b>	Dye penetrant magnetic particle, radiographic or ultrasound tests

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05026C Apply welding principles

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers applying welding principles to meet the statutory and regulatory requirements for welding procedures generally associated with the application of one of the units satisfying Australian Standard 1796 Certificates 1-9.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency covers the underpinning knowledge required to satisfy Australian Standard 1796. It includes knowledge of welding terms, codes and symbols, the effects of heat treatment on metal as it relates to welding, and the logical sequence for a welding process required to be conducted to AS 1796. It covers welding, planning and set up principles for a range of materials and processes.</p> <p>This unit must be assessed in combination with one of the units satisfying the Australian Standard 1796 Certificates 1-9 and these units include:</p> <ul style="list-style-type: none"><li>• MEM05042B Perform welds to code standards using flux core arc welding process</li><li>• MEM05043B Perform welds to code standards using gas metal arc welding process</li><li>• MEM05044B Perform welds to code standards using gas tungsten arc welding process</li><li>• MEM05045B Perform pipe welds to code standards using manual metal arc welding process</li><li>• MEM05046B Perform welds to code standards using manual metal arc welding process.</li></ul> <p>This unit has been developed for Engineering Tradespersons - Fabrication in either apprenticeship or post trade training and the recognition of trade level</p>
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	<p>knowledge of welding principles.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation Band A unit and Specialisation Band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply all statutory and regulatory requirements to welding procedures	1.1.Statutory and safety requirements are applied to welding
2. Interpret all welding terms, codes and symbols	2.1.Welding terms and symbols are correctly interpreted
3. Determine the effects of heat treatment on metal in relation to welding	3.1.Reasons for performing heat treatment are identified 3.2.Processes such as pre-heat/post-heat treatment, stress relieving, normalising and annealing are appropriately applied
4. Plan the logical sequence of welding operations	4.1.Principles of planning and setting up welding are applied 4.2.Where specified, welds are prepared for testing

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- interpreting welding specifications including terms, codes and symbols
- planning the sequence of welding operations

#### Required knowledge

Required knowledge includes:

- any applicable industry standards, national/Australian standards, NOHSC guidelines, state/territory regulatory codes of practice/standards for the applicable welding processes
- safe work practices and procedures
- hazards related to welding
- safety equipment and procedures related to welding activities
- welding terminology
- welding codes and symbols

**REQUIRED SKILLS AND KNOWLEDGE**

- heat treatment processes
- logical sequence for welding processes
- tools, equipment, techniques used in welding
- effect of heat treatment on metal

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to apply welding principles to meet the statutory and regulatory requirements for welding procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills and knowledge covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:

- applying welding statutory and safety requirements to different welding jobs and environments
- interpreting welding codes and symbols including symbols for type of weld, weld size, processing and finishing operations etc
- applying appropriate pre and post-heat treatment processes for a range of welded materials
- setting up weld sequence and preparing materials in a logical manner for welding job.

**Context of and specific resources for assessment**

This unit must be assessed in combination with one of the units satisfying the Australian Standard 1796 Certificates 1-9. Welding to AS 1796 requires both theoretical knowledge and high practical skills. The assessment process for the two units must be designed to identify consistent performance to the standards, the code and specifications across a range of materials and positions. The assessment must also identify a workplace level of performance in terms of defect rates and weld

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	<p>failure rates. It is recommended that assessment involve demonstrations of competency under both workshop and site conditions. This means that the ideal assessment environment is either on the job or a combination of both on and off the job.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically an Engineering Tradesperson - Fabrication and other tradespersons engaged in welding are required to apply welding principles and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit must be assessed in combination with one of the units satisfying the Australian Standard 1796 Certificate 1-9 and these units include:</p> <ul style="list-style-type: none"> <li>• MEM05042B Perform welds to code standards using flux core arc welding process</li> <li>• MEM05043B Perform welds to code standards using gas metal arc welding process</li> <li>• MEM05044B Perform welds to code standards using gas tungsten arc welding process</li> </ul>

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	<ul style="list-style-type: none"> <li>• MEM05045B Perform pipe welds to code standards using manual metal arc welding process</li> <li>• MEM05046B Perform welds to code standards using manual metal arc welding process.</li> </ul> <p>This unit could also be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with applying welding principles to meet the statutory and regulatory requirements for welding procedures or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Statutory and safety requirements</b>	Statutory and safety requirements as required by AS 1796 welding codes
<b>Welding</b>	<p>Welding to AS 1796 using any of the following processes:</p> <ul style="list-style-type: none"> <li>• flux core arc welding</li> <li>• gas metal arc welding</li> <li>• gas tungsten arc welding</li> <li>• manual metal arc welding</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Fabrication
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# MEM05027A Perform aluminothermic welding

## Modification History

Release 1 New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to weld using the aluminothermic welding process. It includes planning and preparing the welding method, preparing materials and the site for aluminothermic welding, carrying out the welding process in accordance with safe working/regulatory requirements and workplace procedures, checking weld conformance, and completing all required documentation.

## Application of the Unit

This unit applies in a maintenance or site environment where the weld quality is not required to meet an Australian Standard. The aluminothermic welding process (commonly referred to as the CADWELD process) is pre-engineered and can be used to make welded connections of copper to copper or copper to steel or other metals. It is also used for header cable taps, conductor splices and terminations, and ground rod connections, or for attaching cathodic protection leads to pipes (steel or cast iron), tanks and structures in which no outside source of heat or power is required. A common use is to join copper cables (wire) for use in direct burial (grounding/earthing) applications.

Work may be undertaken in the field/on site (as distinct from a production/manufacturing facility) and may be undertaken in a trench. In those situations, it may be appropriate to also access *MSAPMOPS363A Organise on site work* for work on site and *MSAPMPER205C Enter confined space* for work in a trench. Work will often be undertaken under a permit to work system in which case it may also be appropriate to access *MSAPMPER200C Work in accordance with an issued permit* and possibly other related permit units.

Where the aluminothermic welding process is required for rail track welding, *TLIW3015A Weld rail using aluminothermic welding process* should be selected from the TLI10 Transport and Logistics Training Package.

**Band: A**

**Unit Weight: 2**

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |                                |  |
|--------------------------------|--|
| 1 Prepare and plan for welding | 1.1 Weld requirements are identified from job instructions   |
|                                | 1.2 Permits and other required authorities are obtained  |
|                                | 1.3 Site and job hazards are identified and appropriate hazard controls implemented  |
|                                | 1.4 Pre-site preparations are completed  |
|                                | 1.5 The locations of welds are identified and assessed in accordance with standard operating procedures and specifications |
|                                | 1.6 Surfaces are cleaned and prepared ready for welding  |
|                                | 1.7 Site is cleared of obstructions and combustible material to minimise risk of accidents and fire                        |
| 2 Prepare equipment for        | 2.1 Welding equipment is set up correctly  |



welding	2.2	Consumables are selected to suit application
3 Perform aluminothermic welding	3.1	Safe welding practices are applied
	3.2	Moulds are fitted and shimmed, sleeved or sealed, as required
	3.3	Materials are pre-heated to standard
	3.4	Materials are welded using aluminothermic method in accordance with approved procedures
	3.5	Welds are cleaned to standard operating procedures
	3.6	Mould is cleaned and inspected to standard operating procedures
4 Check weld conformance	4.1	Weld conformance is assessed in accordance with standard operating procedures and specifications
5 Complete documentation	5.1	Required reports, documentation and/or records are completed in accordance with workplace requirements

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating effectively with others
- reading and interpreting technical data, drawings, procedures, instructions and manuals
- working collaboratively with others when welding materials using the aluminothermic process
- planning and monitoring own work, including predicting consequences and identifying improvements
- selection and use of required personal protective equipment
- implementing fire control procedures

- selecting appropriate welding tools and equipment
- applying precautions and required action to minimise, control or eliminate hazards that may exist during work activities without injury to self or others, or damage to equipment
- reporting and/or rectifying any identified problems, faults or malfunctions that may occur in accordance with regulatory requirements and workplace procedures
- applying defect acceptance criteria and identifying actions to be taken after rejections of welds
- checking compliance between work and job specifications
- completing reports, records and documentation

## Required knowledge

Required knowledge includes:

- relevant safety, occupational health and safety (OHS) and environmental procedures and regulations
- principles of the aluminothermic welding process chemical reaction
- common types of welding imperfections and defects and their causes (e.g. cracks, porosities, mould off centre, stresses in materials, pre-heating offset, sand inclusions and moisture)
- workplace procedures for the welding of materials using the aluminothermic technique
- problems that may occur during the welding of materials using the aluminothermic technique and action that can be taken to report or resolve the problems
- hazards that may exist during the welding of materials using the aluminothermic technique and ways of controlling the risks involved
- contents of relevant technical manuals and instructions
- characteristics of plant and equipment, hardware and components used in welding activities
- impact on work activities of regulatory requirements
- impact of other work activities on welding integrity
- workplace documentation requirements
- site inspection techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to carry out and apply the principles of the aluminothermic welding process and associated equipment, applications and procedures, outlining the
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	main phases and operations, including safety aspects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job, or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with carrying out aluminothermic welding or other units requiring the exercise of the skills and knowledge covered by this unit
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work

environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Work environment</b>	<p>Work environment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• restricted spaces</li> <li>• exposed conditions</li> <li>• controlled or open environments</li> </ul>
<b>Pre-site preparations</b>	<p>Pre-site preparations may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• checking all required equipment and materials</li> <li>• identifying required personal protective equipment</li> <li>• loading all requirements for the job</li> </ul>
<b>Materials to be joined</b>	<p>Materials to be joined may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• common steel</li> <li>• copper-clad steel</li> <li>• Columbium</li> <li>• Niobium</li> <li>• brass</li> <li>• wrought iron</li> <li>• stainless steel</li> <li>• cast iron</li> <li>• galvanised and bethanised steel</li> <li>• bronze</li> <li>• silicon bronze</li> </ul>
<b>Assessment of weld locations</b>	<p>Assessment of weld locations may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• proximity to existing welds or repairs</li> <li>• substrate integrity issues</li> <li>• preparation of pre-qualification samples</li> </ul>
<b>Weld consumables</b>	<p>Weld consumables may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• aluminothermic powder</li> <li>• starting powder</li> <li>• metallic disc</li> </ul>
<b>Equipment</b>	<p>Equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• mould</li> <li>• lute (sealant)</li> <li>• ignition source</li> </ul>

	<ul style="list-style-type: none"> <li>• handle clamps</li> <li>• wire brush</li> <li>• mould scraper</li> <li>• gas pre-heating/cutting equipment</li> </ul>
<b>Personal protective equipment</b>	<p>Personal protective equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• high visibility clothing</li> <li>• fire retardant overalls or long sleeved shirts and long pants</li> <li>• hearing protection</li> <li>• gauntlet type gloves</li> <li>• welding goggles</li> <li>• safety glasses</li> <li>• safety headwear</li> <li>• safety footwear</li> <li>• portable radios/mobile phones</li> <li>• other safety devices</li> </ul>
<b>Procedures and codes</b>	<p>Procedures and codes may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• relevant state/territory OHS legislation together with any nationally approved compliance codes and/or guidelines</li> <li>• relevant state/territory environmental protection requirements</li> <li>• legislation</li> <li>• relevant fire regulations</li> </ul>

## Unit Sector(s)

Fabrication

## Custom Content Section

Not applicable.

## MEM05036C Repair/replace/modify fabrications

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing task requirements; preparing materials; undertaking the repair, replacement or modification of the fabrication; cleaning and finishing to specifications; and inspecting the result.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit requires an integrated level of skills in fabrication maintenance and repair. This unit is intended to build on skills covered by the specialist prerequisites. Processes may involve the simple mark out of materials, and the setting up and operation of a variety of welding and cutting plant/equipment. If individual skills are required, relevant specialist units only should be selected.</p> <p>Where additional or more complex marking out skills are required, refer to Unit MEM12007D (Mark off/out structural fabrications and shapes). If machines and equipment for forming, bending or shaping are required, Unit MEM05010C (Apply fabrication, forming and shaping techniques) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05011D	Assemble fabricated components
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 2</b>	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05011D	Assemble fabricated components
	MEM05017D	Weld using gas metal arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 3</b>	MEM05004C	Perform routine oxy acetylene welding
	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05011D	Assemble fabricated components
	MEM05022C	Perform advanced welding using oxy acetylene welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 4</b>	MEM05005B	Carry out mechanical cutting
	MEM05007C	Perform manual heating and thermal cutting
	MEM05011D	Assemble fabricated components
	MEM05019D	Weld using gas tungsten arc welding process
	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes



Prerequisite units		
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess and process repair, replacement, modification requirement	<p>1.1. Work requirements are determined from job sheet, instruction or visual inspection.</p> <p>1.2. Specifications and drawings are obtained and interpreted where required.</p> <p>1.3. Fabrication is inspected and suitability for repair/replacement/modification determined.</p>
2. Assess and process	2.1. Material requirements are assessed in accordance

ELEMENT	PERFORMANCE CRITERIA
material requirements	<p>with relevant codes, manufacturers' specifications and standard operating procedures.</p> <p>2.2. Materials are obtained/requisitioned according to standard operating procedures.</p> <p>2.3. Tool and equipment requirements are assessed and obtained, where required, according to standard operating procedures.</p>
3. Prepare materials	<p>3.1. Fabrication for repair/replacement and/or modification is prepared to specification using acceptable workplace practices, tools and equipment.</p> <p>3.2. Materials are marked out and prepared to specifications with minimum wastage using correct principles, tools, equipment and procedures.</p> <p>3.3. Materials are cut, bent, rolled, shaped or formed to specifications using appropriate fabrication techniques/procedures, tools and equipment.</p> <p>3.4. Where required, items are marked for identification.</p>
4. Repair, replace or modify fabrication	<p>4.1. Using suitable clamping methods, equipment, jigs and fixtures, materials are positioned/clamped for welding.</p> <p>4.2. Pre-tack checks are undertaken and compliance with specifications is determined prior to tack welding in position.</p> <p>4.3. Welding equipment is prepared and settings are adjusted according to requirements.</p> <p>4.4. Immediate work site environment is checked to ensure compliance with safety requirements and procedures.</p> <p>4.5. Material or item is tack welded using appropriate distortion minimisation techniques and procedures.</p> <p>4.6. Material or item is checked against specifications prior to welding.</p> <p>4.7. Material or item is welded to specifications using techniques and procedures appropriate to job requirements.</p>
5. Finish and inspect repair, replacements and/or modification	<p>5.1. Repair, replacement and/or modification is cleaned and finished to specifications using appropriate workplace practices.</p> <p>5.2. Welds are visually inspected to assess weld quality against predetermined specifications.</p> <p>5.3. Completed repair, replacement and/or modification is assessed against specifications.</p>

ELEMENT	PERFORMANCE CRITERIA
	5.4. Maintenance report is prepared and lodged according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- visually inspecting fabrication for defects, faults, and compliance
- marking out
- minimising wastage of materials
- cutting, bending, rolling, shaping or forming materials
- positioning and clamping materials for welding
- undertaking pre-welding/tacking checks
- setting up and adjusting welding equipment
- tack welding
- welding according to all relevant codes, and specifications
- cleaning and finishing materials/fabrication
- reading and interpreting job sheets, specifications, drawings, standard operating procedures, manufacturer documentation and other literature to the level required by this unit
- assessing material and equipment requirements
- using measuring skills for preparing and marking out materials and for checking modification against specifications
- completing short reports using relevant terminology and format

#### Required knowledge

Look for evidence that confirms knowledge of:

- applicable industry standards, national/Australian standards, NOHSC guidelines, State/Territory regulatory codes of practice/standards
- characteristics of faults, defects and or non-compliance
- means of rectifying faults, defects and/or non-compliance by rework or additional work, or by replacement of components/materials
- effects of proposed modifications on the fabrication
- reasons for selection of specific materials, tools, equipment and consumables

## REQUIRED SKILLS AND KNOWLEDGE

- marking out principles, techniques
- material preparation processes
- clamping method(s) for the welds undertaken.
- location of all materials to be welded
- weld specifications
- equipment, consumables and settings required to achieve the weld specification
- distortion minimisation procedures and methods for rectifying any distortion of materials
- material cleaning and finishing processes for the repair/replacement/modification
- reporting requirements
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and hazard control measures associated with repairing, replacing or modifying fabrications

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to integrate skills in fabrication maintenance and repair/replace/modify fabrications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with repairing, replacing or modifying fabrications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Fabrication inspected</b>	Determine defects/faults, non-compliance with specifications, repair/replacement/modification
<b>Marked out</b>	Marking out principles, techniques

<b>RANGE STATEMENT</b>	
<b>Marked for identification</b>	To undergo repair, replacement and/or modification, to be cut, bent, rolled, shaped or formed to specifications
<b>Clamping methods</b>	Automatic, semi-automatic, manual methods
<b>Welding equipment</b>	MMAW, GMAW, GTAW

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Fabrication
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## MEM05037C Perform geometric development

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills required by an Engineering Tradesperson - Fabrication for marking out general fabrications using geometric development techniques. The marking out is done to specifications interpreted from technical drawings and job specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies in jobbing workshops and involves the development of templates and general fabricating using geometrical layout techniques. The marking out is undertaken to specified measurements, tolerances and shapes. Skills covered by this unit are generally applied in occupational and work situations associated with steel fabrication, boilermaking or sheet metal work.</p> <p>This unit has been developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in geometric development and marking out.</p> <p>For skills required for marking out activities associated with general engineering and maintenance functions, see the following units:</p> <ul style="list-style-type: none"><li>• MEM07005C Perform general machining</li><li>• MEM12006C Mark off/out (general engineering)</li><li>• MEM18006C Repair and fit engineering components.</li></ul> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Transfer dimensions from a detail drawing to work	<p>1.1.Specifications and work requirements are determined and understood using correct and appropriate calculations</p> <p>1.2.Development is carried out to specifications or</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>standard operating procedures using appropriate tools and equipment</p> <p>1.3.Datum points are correctly established and marked appropriate to task requirements</p>
2. Make templates as required	<p>2.1.Appropriate template material is chosen</p> <p>2.2.Templates are produced to specification</p> <p>2.3.Correct storage procedures are followed including labelling and identification to standard operating procedures</p>
3. Develop patterns as required	<p>3.1.Parallel line, radial line and triangulation development methods are chosen and applied</p> <p>3.2.Allowances for fabrication and assembly are correctly determined and transferred</p>
4. Interpret relevant codes, standards and symbols	<p>4.1.Relevant standards/codes and symbols are interpreted</p> <p>4.2.Requirements of standards/codes are interpreted and applied to materials and processes</p>
5. Estimate quantities of materials from detail drawings	<p>5.1.Materials are correctly identified</p> <p>5.2.Quantities are estimated from drawings</p> <p>5.3.Material wastage is minimised</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- performing geometric calculations
- carrying out geometric development
- establishing datum points
- producing templates to specification
- labelling and storing templates
- developing patterns
- making fabrication and assembly allowances
- determining material and component quantities

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• minimising material wastage</li> </ul>
<b>Required knowledge</b>
<p>Required knowledge includes:</p> <ul style="list-style-type: none"> <li>• specifications of work</li> <li>• tools and equipment</li> <li>• development preparation</li> <li>• datum points</li> <li>• materials used for the preparation of templates</li> <li>• manufacturing allowance considerations</li> <li>• template development, labelling, identification and storage requirements</li> <li>• development methods and applications</li> <li>• fabrication and assembly allowances</li> <li>• sources of data on fabrication</li> <li>• relevant standards and codes</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to mark out general fabrications using geometric development. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:</p> <ul style="list-style-type: none"> <li>• examining detailed drawings for fabrication requirements and specifications including materials, measurements and tolerances, joining methods, standards and code requirements</li> <li>• correctly calculating allowances for fabrication and</li> </ul>

**EVIDENCE GUIDE**

	<p>assembly including shrinkage, thickness and inside/outside measurements</p> <ul style="list-style-type: none"> <li>• correctly establishing and marking datum points</li> <li>• selecting and using parallel line, radial line and triangulation development methods with minimum material wastage with accurate dimensions and allowances</li> <li>• accurately producing templates.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency in marking out using geometric development as applied to a sheet metal or metal fabrication environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Fabrication work are required to apply their geometric development skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

**EVIDENCE GUIDE****Guidance information for assessment**

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying geometric development or other units requiring the exercise of the skills and knowledge covered by this unit.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Template material**

Template material may include:

- steel plate
- perspex
- timber
- cardboard
- paper

**Storage procedures**

Storage procedures may include:

- labelling
- identification (e.g. template lofts)

**Development methods**

Development methods may include:

- parallel line
- radial line
- triangulation

**Allowances**

Allowances may include:

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• thickness</li> <li>• bend</li> <li>• pitch</li> <li>• angle</li> <li>• circumference</li> <li>• perimeter</li> </ul>
<b>Standards/codes and symbols</b>	All work carried out in accordance with legislative and regulatory requirements

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05038B Perform advanced geometric development - cylindrical/rectangular

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers marking out complex cylindrical/rectangular fabrications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit reflects the advanced skills required to calculate parallel line developments.</p> <p>In the context of light gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular sheetmetal fabrications used in square/rectangular ventilation ducting, air-conditioning and cylindrical components.</p> <p>In the context of heavy gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular plate and/or pipe fabrications used in ducting, extraction, piping and cylindrical components.</p> <p>Marking out skills for general engineering and maintenance is covered by Units MEM12006C (Mark off/out [general engineering]), MEM07005C (Perform general machining), MEM18006C (Repair and fit engineering components) and MEM18014B (Manufacture press tools and gauges)</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05037C	Perform geometric development
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Mark off/out	1.1.Specifications and work requirements are determined

ELEMENT	PERFORMANCE CRITERIA
fabrications	<p>using correct calculations appropriate to the task.</p> <p>1.2. Development is carried out to specifications or standard operating procedures using tools and equipment appropriate to the task.</p> <p>1.3. Datum points are correctly established and indicated.</p> <p>1.4. Allowances are correctly determined and marked (thickness, bend, pitch, angle, circumference, perimeter).</p>
2. Make templates as required	<p>2.1. Template material is selected appropriate to the marking out requirements.</p> <p>2.2. Templates are accurately produced.</p> <p>2.3. Allowances are correctly determined and transferred.</p> <p>2.4. Templates for rolling, bending, pressing, drilling and profiling are accurately produced.</p> <p>2.5. Correct storage procedures are followed including labelling and identification to standard operating procedures.</p>
3. Develop patterns as required	<p>3.1. The most appropriate development method for the task is chosen and applied.</p> <p>3.2. Allowances are correctly determined and transferred.</p>
4. Interpret relevant codes, standards and symbols	<p>4.1. Relevant standards/codes and symbols are interpreted.</p> <p>4.2. Requirements of standards/codes are interpreted and applied to materials and processes.</p>
5. Estimate quantities of materials from engineering drawings	<p>5.1. Materials are correctly identified.</p> <p>5.2. Quantities are estimated from drawings.</p> <p>5.3. Material use is optimised and wastage is minimised.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing material calculations



## REQUIRED SKILLS AND KNOWLEDGE

- carrying out geometric development
- establishing datum points
- calculating allowances
- marking out techniques
- producing template/patterns
- labelling and storing template/patterns
- developing template/patterns
- determining and transferring fabrication and assembly allowances
- applying relevant codes/standards
- determining material and component quantities using geometric formulae
- applying principles for minimising material wastage

### Required knowledge

Look for evidence that confirms knowledge of:

- tools, equipment, techniques in template/patterns
- datum points
- geometrical principles and formulae
- calculations of allowances:
  - thickness
  - bend
  - pitch
  - angle
  - circumference
  - perimeter
- template/patterns materials
- manufacturers' allowances on materials
- procedures for making template/patterns
- template/patterns labelling, identification and storage
- fabrication and assembly allowances
- effects of material type/thickness on fabrication and assembly allowances
- sources of data on fabrication/assembly allowances
- relevant standards, codes, symbols
- fabrication materials
- optimising material use and minimising material wastage
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to mark out complex cylindrical/rectangular fabrications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced geometric development or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Fabrications**

<b>Fabrications</b>	May include hoppers, chutes and other items involving compound bends and double offsets
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**Allowances**

<b>Allowances</b>	Thickness, bend, pitch, angle, circumference, perimeter
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**Template material**

<b>Template material</b>	Steel plate, perspex, timber
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**Templates produced**

<b>Templates produced</b>	For rolling, bending, pressing, drilling and profiling
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**Storage procedures**

<b>Storage procedures</b>	Labelling, identification, e.g. template lofts
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**Development method**

<b>Development method</b>	May include parallel line, radial line and triangulation
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**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05039B Perform advanced geometric development - conical

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers marking out complex conical fabrications using advanced geometric development techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit reflects the advanced skills required to calculate cutting, bending lines and developments. Applications may include hoppers with round/rectangular branch intersections.</p> <p>In the context of light gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular sheetmetal fabrications used in square/rectangular ventilation ducting, air-conditioning&amp;cylindrical components.</p> <p>In the context of heavy gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular plate and/or pipe fabrications used in ducting, extraction, piping and cylindrical components.</p> <p>Marking out skills for general engineering and maintenance are covered by Unit MEM12006C (Mark off/out (general engineering)), MEM07005C (Perform general machining), Unit MEM18006C (Repair and fit engineering components) and Unit MEM18014B (Tool, gauge and die manufacture)</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05037C	Perform geometric development
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Mark off/out	1.1.Specifications and work requirements are determined

ELEMENT	PERFORMANCE CRITERIA
fabrications	<p>using correct calculations appropriate to the task.</p> <p>1.2. Development is carried out to specifications or standard operating procedures using tools and equipment appropriate to the task.</p> <p>1.3. Datum points are correctly established and indicated.</p> <p>1.4. Allowances are correctly determined and marked (thickness, bend, pitch, angle, circumference, perimeter).</p>
2. Make templates as required	<p>2.1. Template material is selected appropriate to the marking out requirements.</p> <p>2.2. Templates are accurately produced.</p> <p>2.3. Allowances are correctly determined and transferred.</p> <p>2.4. Templates for rolling, bending, pressing, drilling and profiling are accurately produced.</p> <p>2.5. Correct storage procedures are followed including labelling and identification to standard operating procedures.</p>
3. Develop patterns as required	<p>3.1. The most appropriate development method for the task is chosen and applied.</p> <p>3.2. Allowances are correctly determined and transferred.</p>
4. Interpret relevant codes, standards and symbols	<p>4.1. Relevant standards/codes and symbols are interpreted.</p> <p>4.2. Requirements of standards/codes are interpreted and applied to materials and processes.</p>
5. Estimate quantities of materials from engineering drawings	<p>5.1. Materials are correctly identified.</p> <p>5.2. Quantities are estimated from drawing.</p> <p>5.3. Material use is optimised and wastage is minimised.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing material calculations

## REQUIRED SKILLS AND KNOWLEDGE

- carrying out geometric development
- establishing datum points
- calculating allowances
- marking out techniques
- producing template/patterns
- labelling and storing template/patterns
- developing template/patterns
- determining and transferring fabrication and assembly allowances
- applying relevant codes/standards
- calculating material and component quantities by applying geometric formulae
- applying principles for minimising material wastage

### Required knowledge

Look for evidence that confirms knowledge of:

- tools, equipment, techniques in template/ pattern development
- datum points
- geometrical principles, and formulae
- template/patterns materials
- procedures for making template/patterns
- template/patterns labelling, identification, storage and development
- calculations of allowances:
  - thickness
  - bend
  - pitch
  - angle
  - circumference
  - perimeter
- manufacturers' allowances on materials
- fabrication and assembly allowances
- effects of material type/thickness on fabrication and assembly allowances
- sources of data on fabrication/ assembly allowances
- relevant standards, codes, symbols
- fabrication materials
- optimising material use and minimising material wastage
- safe work practices and procedures



## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to mark out complex conical fabrications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with marking out complex conical fabrications or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Fabrications**

Hoppers with round/rectangular branch intersections

**Allowances**

Thickness, bend, pitch, angle, circumference, perimeter

**Template material**

Steel plate, perspex, timber

**Templates produced**

Rolling, bending, pressing, drilling and profiling, cutting

**Storage procedures**

Labelling, identification, e.g. template lofts

**Development methods**

Parallel line, radial line and triangulation

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05040B Perform advanced geometric development - transitions

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers marking out complex fabrications using geometric development.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit reflects the advanced skills required to calculate cutting, bending lines and developments. Fabrications may include elliptical shapes, curves, spirals etc. Patterns may include complex and irregular shapes.</p> <p>In the context of light gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular sheetmetal fabrications used in square/rectangular ventilation ducting, air-conditioning&amp;cylindrical components.</p> <p>In the context of heavy gauge fabrications this unit may apply to marking out complex cylindrical&amp;rectangular plate and/or pipe fabrications used in ducting, extraction, piping and cylindrical components.</p> <p>Marking out skills for general engineering and maintenance are covered by Units MEM12006C (Mark off/out [general engineering]), MEM07005C (Perform general machining), MEM18006C (Repair and fit engineering components) and MEM18014B (Manufacture tools, gauges and dies).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05037C	Perform geometric development
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Mark off/out	1.1.Specifications and work requirements are determined

ELEMENT	PERFORMANCE CRITERIA
fabrications	<p>using correct calculations appropriate to the task.</p> <p>1.2. Development is carried out to specifications or standard operating procedures using tools and equipment appropriate to the task.</p> <p>1.3. Datum points are correctly established and indicated.</p> <p>1.4. Allowances are correctly determined and marked (thickness, bend, pitch, angle, circumference, contraction, etc.).</p>
2. Make templates as required	<p>2.1. Template material is selected appropriate to the marking out requirements.</p> <p>2.2. Templates are accurately produced.</p> <p>2.3. Allowances are correctly determined and transferred.</p> <p>2.4. Templates for rolling, bending, pressing, drilling and profiling are accurately produced.</p> <p>2.5. Correct storage procedures are followed including labelling and identification to standard operating procedures.</p>
3. Develop patterns as required	<p>3.1. The most appropriate development method for the task is chosen and applied.</p> <p>3.2. Allowances are correctly determined and transferred.</p>
4. Interpret relevant codes, standards and symbols	<p>4.1. Relevant standards/codes and symbols are interpreted.</p> <p>4.2. Requirements of standards/codes are interpreted and applied to materials and processes.</p>
5. Estimate quantities of materials from engineering drawings	<p>5.1. Materials are correctly identified.</p> <p>5.2. Quantities are estimated from drawings.</p> <p>5.3. Material use is optimised and wastage is minimised.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing material calculations

## REQUIRED SKILLS AND KNOWLEDGE

- carrying out geometric development
- establishing datum points
- calculating allowances
- marking out techniques
- producing template/patterns
- labelling and storing template/patterns
- developing template/patterns
- determining and transferring fabrication and assembly allowances
- applying relevant codes/standards
- determining material and component quantities by applying geometric formulae
- applying principles for optimising material use and minimising material wastage

### Required knowledge

Look for evidence that confirms knowledge of:

- tools, equipment, techniques in template/patterns development
- datum points
- geometrical principles and formulae
- calculations of allowances:
  - thickness
  - bend
  - pitch
  - angle
  - circumference
  - perimeter
- template/patterns materials
- template/patterns development
- manufacturers' allowances on materials
- procedures for making template/patterns
- template/patterns labelling, identification and storage
- fabrication and assembly allowances
- effects of material type/thickness on fabrication and assembly allowances
- sources of data on fabrication/assembly allowances
- relevant standards, codes, symbols
- fabrication materials
- optimising material use and minimising material wastage
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to mark out complex fabrications using geometric development of transitions. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced geometric development of transitions or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Fabrications</b>	May include elliptical shapes, curves, spirals etc.
<b>Allowances</b>	Thickness, bend, pitch, angle, circumference, perimeter
<b>Template material</b>	Steel plate, perspex, timber
<b>Templates produced</b>	Rolling, bending, pressing, drilling and profiling, cutting
<b>Storage procedures</b>	Labelling, identification, e.g. template lofts
<b>Development methods</b>	Parallel line, radial line and triangulation

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05041B Weld using powder flame spraying

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers powder spraying, using hot and/or cold processes on a range of heavy or light materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welding of materials using powder spraying equipment where powders are fed through the flame and are deposited onto the surface to be built up or joined.</p> <p>For remedial action using machining processes other than grinding with grinding wheels (ceramic or other), the appropriate machining units should also be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05004C	Perform routine oxy acetylene welding
	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare work for spray welding	1.1.Spray weld requirements are identified from specifications and/or drawings. 1.2.Work is prepared using appropriate tools and techniques. 1.3.Work is assembled/aligned to specifications as required.
2. Select spray welding equipment and powders	2.1.Appropriate spray welding equipment and consumables for materials and work requirements are selected.
3. Set up spray welding equipment	3.1.Gas setting on spray welding equipment is adjusted to task requirements.
4. Implement distortion prevention/control measures	4.1.Distortion prevention/control measures are identified. 4.2.Appropriate distortion prevention/control measures are applied to minimise and rectify distortion.
5. Spray weld material	5.1.Spray weld is correctly deposited to specification.
6. Inspect spray weld	6.1.Weld area/joints are visually inspected against specification.

ELEMENT	PERFORMANCE CRITERIA
	6.2. Detected defects are removed with minimum loss of sound material.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials
- selecting equipment and powders
- setting up equipment
- spray welding material
- identifying defects in welds
- rectifying weld defects
- applying techniques for distortion prevention and rectification
- cleaning welds
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- correct welding equipment, hoses, tips, hand pieces and filler powder
- procedures and processes for material preparation
- procedures and processes for joint preparations
- causes of distortion for materials within the scope of this unit
- causes of defects and methods of rectification
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to powder spray, using hot and/or cold processes, on a range of heavy or light materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using powder spraying equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Welds</b>	Fillet and butt in all positions
<b>Prepared</b>	Preheating, setting up of jigs, fixtures, clamps, etc., joint preparation e.g. bevelling
<b>Equipment</b>	AC or DC welding machines
<b>Materials</b>	Steels, carbon steels, cast iron, etc. or non-metallic materials (plastic/nylon)
<b>Distortion prevention</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Defects</b>	Porosity, slag inclusions, discontinuities, lack of penetration, undercut
<b>Removal of defects</b>	Oxy acetylene and air arc equipment, grinding devices

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05042B Perform welds to code standards using flux core arc welding process

### Modification History

Release 3 - equivalent. Australian Standard code corrected to AS4041.

### Unit Descriptor

This unit covers preparing and producing welds to code standards using flux core arc welding (FCAW).

### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of butt and fillet welds in all positions. Welds in this unit are associated with high quality fabrications.</p> <p>Welds produced to the standard of this unit would typically conform to Australian Standard 1210, AS 4041, American Society of Mechanical Engineers (ASME) IX or equivalent. This unit, in conjunction with Unit MEM05026C (Apply welding principles), may satisfy the requirements of AS 1796 Certificate 8F.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05026C	Apply welding principles
	MEM05047B	Weld using flux core arc welding process
	MEM05048B	Perform advanced welding using flux core arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain welding equipment	1.1. Routine maintenance is performed on welding equipment.
2. Prepare welding materials and equipment for FCAW welding to code standard	2.1. Weld requirements for FCAW welding to code standards are determined. 2.2. Materials are prepared to produce weld to code standard. 2.3. Welding equipment is set up correctly.
3. Weld joints using FCAW to procedure specifications	3.1. Materials are welded as per weld procedure specification.
4. Ensure weld quality	4.1. Discontinuities are rectified to ensure conformance to code requirements. 4.2. Weld records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- depositing welds to procedure requirements
- determining weld outcomes, consumables and settings from welding procedure specification
- interpreting technical drawings and weld specifications for welding to code standards using FCAW
- using hand and power tools to prepare and weld materials to code standard
- using measurement and numeracy skills for welding to code standards
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- requirements to produce welds to quality of AS1210, AS4041, ASME IX or equivalent
- safe welding practices
- use and application of personal protective equipment for FCAW
- relevant standards or codes
- methods for preparing plate and pipe for code standard welding
- pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard
- requirements for maintaining weld records to code standard
- hazards and control measures associated with welding, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare and produce welds to code standards using FCAW process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

**EVIDENCE GUIDE**

	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing welds to code standards using flux core arc welding process, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Routine maintenance</b>	Ensuring gun, cable, contact tip etc. are in good condition
<b>Prepared</b>	Flame cut and ground or machined; preheating, setting up of jigs, fixtures, clamps, etc.
<b>Materials</b>	Carbon/manganese steel, low alloy steel etc. on plate, pipe and rolled steel sections

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05043B Perform welds to code standards using gas metal arc welding process

### Modification History

Release 4 - equivalent. Australian Standard code corrected to AS4041.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing and producing welds to code standards using gas metal arc welding (GMAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to performing GMAW to code standard carried out using a range of materials. Welds in this unit are associated with high quality fabrications.</p> <p>Butt and fillet welds in the flat, horizontal, vertical and overhead positions would be applied to meet Australian Standards 1210, AS 4041, ASME IX or equivalent.</p> <p>This unit, in conjunction with Unit MEM05026C (Apply welding principles), may satisfy the requirements of AS 1796 Certificate 8G.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation Band A unit and Specialisation Band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05017D	Weld using gas metal arc welding process
	MEM05018C	Perform advanced welding using gas metal arc welding process
	MEM05026C	Apply welding principles
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain welding equipment	1.1. Routine maintenance is performed on welding equipment.
2. Prepare welding materials and equipment for GMAW welding to code standard	2.1. Weld requirements for GMAW welding to code standards are determined. 2.2. Materials are prepared to produce weld to code standard. 2.3. Welding equipment is set up correctly.
3. Weld joints using GMAW to procedure specifications	3.1. Materials are welded as per weld procedure specification.
4. Ensure weld quality	4.1. Discontinuities are rectified to ensure conformance to code requirements. 4.2. Weld records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- depositing welds to procedure requirements
- determining weld outcomes, consumables and settings from welding procedure specification
- interpreting technical drawings and weld specifications for welding to code standards using GMAW
- using hand and power tools to prepare and weld materials to code standard
- using measurement and numeracy skills for welding to code standards
- using language and literacy skills to enable completion of weld records

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- requirements to produce welds to quality of AS 1210, AS 4041, ASME IX or equivalent
- safe welding practices
- use and application of personal protective equipment for GMAW
- relevant standards or codes
- methods for preparing plate and pipe for code standard welding
- pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard
- requirements for maintaining weld records to code standard
- hazard and control measures associated with welding, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare and produce welds to code standards using GMAW process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing welds to code standards using gas metal arc welding process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Routine maintenance</b>	Ensuring gun, liner, contact tip etc. are in serviceable condition
<b>Prepared</b>	Flame cut and ground or machined; preheating, setting up of jigs, fixtures, clamps, etc.
<b>Materials</b>	Carbon/manganese steel, low alloy steel and

RANGE STATEMENT	
	aluminium materials, etc. on plate, pipe and rolled steel sections

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05044B Perform welds to code standards using gas tungsten arc welding process

### Modification History

Release 3 - equivalent. Australian Standard code corrected to AS4041.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing and producing welds to code standards using gas tungsten arc welding (GTAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to welds associated with high quality fabrications, using a range of materials. Butt and fillet welds in the flat, horizontal, vertical and overhead positions would be applied to meet Australian Standards 1210, AS 4041, ASME IX or equivalent. The unit, together with Unit MEM05026C (Apply welding principles), may satisfy the requirements of AS 1796 Certificate 7.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05019D	Weld using gas tungsten arc welding process
	MEM05020C	Perform advanced welding using gas tungsten arc welding process
	MEM05026C	Apply welding principles
	MEM05049B	Perform routine gas tungsten arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain welding equipment	1.1. Routine maintenance is performed on welding equipment.
2. Prepare welding materials and equipment for GTAW welding to code standard	2.1. Weld requirements for GTAW welding to code standards are determined. 2.2. Materials are prepared to produce weld to code standard. 2.3. Welding equipment is set up correctly.
3. Weld joints using GTAW to procedure specifications	3.1. Materials are welded as per weld procedure specification.
4. Ensure weld quality	4.1. Discontinuities are rectified to ensure conformance to code requirements. 4.2. Weld records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
<p>Look for evidence that confirms skills in:</p> <ul style="list-style-type: none"> <li>• depositing welds to procedure requirements</li> <li>• determining weld outcomes, consumables and settings from welding procedure specification</li> <li>• interpreting technical drawings and weld specifications for welding to code standards using GTAW</li> <li>• using hand and power tools to prepare and weld materials to code standard</li> <li>• using measurement and numeracy skills for welding to code standards</li> <li>• reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings</li> </ul>

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• following oral instructions</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• requirements to produce welds to quality of AS 1210, AS 4041, ASME IX or equivalent</li> <li>• safe welding practices</li> <li>• use and application of personal protective equipment for GTAW</li> <li>• relevant standards or codes</li> <li>• methods for preparing plate and pipe for code standard welding</li> <li>• pre-welding and post-welding heating methods and requirements for plate and pipe welding to code standard</li> <li>• requirements for maintaining weld records to code standard</li> <li>• hazards and control measures associated with welding, including housekeeping</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to prepare and produce welds to code standards using GTAW process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working</p>



<b>EVIDENCE GUIDE</b>	
	<p>alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing welds to code standards using gas tungsten arc welding process (GTAW) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Routine maintenance</b>	Ensuring hand piece, gas shroud, flow meter etc. are in serviceable condition
<b>Prepared</b>	Flame cut and ground or machined, preheating, setting up of jigs, fixtures, clamps, etc.

## **RANGE STATEMENT**

<b>Materials</b>	Carbon/manganese steel, low alloy steel and aluminium materials, etc. on plate, pipe and rolled steel sections
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## **Unit Sector(s)**

<b>Unit sector</b>	
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## **Co-requisite units**

<b>Co-requisite units</b>		

## **Competency field**

<b>Competency field</b>	
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## MEM05045B Perform pipe welds to code standards using manual metal arc welding process

### Modification History

Release 3 - equivalent. Australian Standard code corrected to AS4041.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing and producing pipe welds to code standards using manual metal arc welding (MMAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to MMAW to code standard carried out using a range of materials. Welds in this unit are associated with high quality fabrications. Butt welds in pipe with the axis horizontal, vertical and/or askew would be applied to meet Australian Standards 1210, AS 4041, ASME IX or equivalent. The unit, together with Unit MEM05026C (Apply welding principles), may satisfy the requirements of AS 1796 Certificates 2 and 4.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05016C	Perform advanced welding using manual metal arc welding process
	MEM05026C	Apply welding principles
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain welding equipment	1.1.Routine maintenance is performed on welding equipment.
2. Prepare welding materials and equipment for MMAW pipe welding to code standards	2.1.Weld requirements for MMAW welding to code standards are determined. 2.2.Welding equipment is set up correctly. 2.3.Materials are prepared to produce pipe weld to code standard.
3. Weld pipe using MMAW to procedure specifications	3.1.Materials are welded as per weld procedure specification.
4. Ensure weld quality	4.1.Discontinuities are rectified to ensure conformance to code requirements. 4.2.Weld records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- depositing welds to procedure requirements.
- determining weld outcomes, consumables and settings from welding procedure specification
- interpreting technical drawings and weld specifications for welding to code standards using MMAW
- using hand and power tools to prepare and weld materials to code standard
- using measurement and numeracy skills for welding to code standards

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• using language and literacy skills to enable completion of weld records</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• requirements to produce welds to quality of AS 1210, AS 4041, ASME IX or equivalent</li> <li>• safe welding practices</li> <li>• use and application of personal protective equipment for MMAW</li> <li>• knowledge of appropriate standards or codes</li> <li>• methods for preparing pipe for code standard welding</li> <li>• pre-welding and post-welding heating methods and requirements for pipe welding to code standard</li> <li>• requirements for maintaining weld records to code standard</li> <li>• hazards and control measures associated with welding, including housekeeping</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to perform pipe welds to code standards using MMAW process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part</p>

<b>EVIDENCE GUIDE</b>	
	<p>of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the preparation and production of welds or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Routine maintenance</b>	Ensuring leads, hand pieces etc. are in serviceable condition, and correct current carrying capacity
<b>Prepare welding materials</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Prepared</b>	Flame cut and ground or machined

## RANGE STATEMENT

### Materials

Carbon/manganese steel, stainless steel and low alloy steel materials, etc.

## Unit Sector(s)

### Unit sector

## Co-requisite units

### Co-requisite units


## Competency field

### Competency field

Fabrication



## MEM05046B Perform welds to code standards using manual metal arc welding process

### Modification History

Release 3 - equivalent. Australian Standard code corrected to AS4041.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing and producing welds to code standards using manual metal arc welding (MMAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to MMAW to code standard carried out using a range of materials. Welds in this unit are associated with high quality fabrications. Butt and fillet welds in the flat, horizontal, vertical and overhead positions would be applied to meet Australian Standards 1210, AS 4041, ASME IX or equivalent. This unit, together with Unit MEM05026C (Apply welding principles), may satisfy the requirements of AS 1796 Certificates 1, 1E, 3 and 3E.</p> <p>Where advanced manual thermal cutting, gouging and shaping is carried out, Unit MEM05008C (Perform advanced manual thermal cutting, gouging and shaping) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05016C	Perform advanced welding using manual metal arc welding process
	MEM05026C	Apply welding principles
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain welding equipment	1.1.Routine maintenance is performed on welding equipment.
2. Prepare welding materials and equipment for MMAW welding to code standard	2.1.Weld requirements for MMAW welding to code standards are determined. 2.2.Materials are prepared to produce weld to code standard. 2.3.Welding equipment is set up correctly.
3. Weld joints using MMAW to procedure specifications	3.1.Materials are welded as per weld procedure specification.
4. Ensure weld quality	4.1.Discontinuities are rectified to ensure conformance to code requirements. 4.2.Weld records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- depositing welds to procedure requirements
- determining weld outcomes, consumables and settings from welding procedure

## REQUIRED SKILLS AND KNOWLEDGE

specification

- interpreting technical drawings and weld specifications for welding to code standards using MMAW
- using hand and power tools to prepare and weld materials to code standard
- using measurement and numeracy skills for welding to code standards
- using language and literacy skills to enable completion of weld records

### Required knowledge

Look for evidence that confirms knowledge of:

- requirements to produce welds to quality of AS 1210, AS 4041, ASME IX or equivalent
- safe welding practices
- use and application of personal protective equipment for MMAW
- knowledge of appropriate standards or codes
- methods for preparing plate for code standard welding
- pre-welding and post-welding heating methods and requirements for plate welding to code standard
- requirements for maintaining weld records to code standard
- hazards and control measures associated with welding, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform welds to code standards using MMAW process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

## EVIDENCE GUIDE

<b>assessment</b>	<p>combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the preparation and production of welds or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Routine maintenance</b>	Ensuring leads, hand pieces etc. are in serviceable condition, and correct current carrying capacity
<b>Prepare welding materials</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Prepared</b>	Flame cut and ground or machined
<b>Materials</b>	Carbon/manganese steel, stainless steel and low alloy steel materials, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05047B Weld using flux core arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out flux core arc welding (FCAW) and inspecting for and correcting defects.
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### Application of the Unit

<b>Application of the unit</b>	<p>Welds are associated with heavy or light fabrication. Fillet and butt welds in all positions would typically be performed on a range of materials that may include carbon steel or stainless steel etc.</p> <p>Welding procedures and the skills are applied to a range of fabrication activities.</p> <p>As a guide, welds produced to the standard of this unit would typically conform to Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent.</p> <p>Where thermal processes, hand and/or power tools are required, the appropriate specialisation units should be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare materials for flux core arc welding	<p>1.1.Weld requirements are identified from specifications and/or drawings.</p> <p>1.2.Materials are correctly prepared.</p>



ELEMENT	PERFORMANCE CRITERIA
	1.3. Materials are assembled/aligned to specification where required.
2. Select welding machine components	2.1. Welding machine settings accessories and consumables are identified.
3. Assemble and set up welding equipment	3.1. Welding equipment is assembled and set up.
4. Minimise and rectify distortion	4.1. Appropriate distortion prevention measures are selected. 4.2. Distortion is rectified.
5. Weld to job specification using FCAW	5.1. Weld deposit is to specification. 5.2. Joints are cleaned to specifications.
6. Ensure weld conformance	6.1. Defects are removed with minimum loss of sound metal using correct and appropriate techniques and tools. 6.2. Weld joints are visually inspected for conformance to specifications.
7. Maintain weld records	7.1. Weld records are completed correctly.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying and interpreting appropriate standard e.g. Australian Standard 1554 General Purpose, American Bureau of Shipping (ABS) or equivalent
- depositing welds in accordance with appropriate standards
- following specifications and drawings
- using appropriate tools and techniques to prepare material for welding
- undertaking distortion prevention and rectification
- cleaning the welded joint using appropriate tools and techniques
- removing weld defects to achieve a minimum amount of sound metal with the defect.

**REQUIRED SKILLS AND KNOWLEDGE**

- reading and interpreting information on written job instructions, specifications, standard operating procedures and drawings
- recording routine information related to FCAW onto proformas and standard workplace forms
- following oral instructions
- using measurement skills relating to joint preparation and FCAW

**Required knowledge**

Look for evidence that confirms knowledge of:

- types of gases and their uses
- the relationships between amperage/wire feed, voltage, gas flow, electrode, contact tip and material
- material preparation
- polarity
- electrode stickout
- joint preparations
- electrode classification
- causes of distortion for materials within the scope of this unit
- safe welding practices
- use and application of personal protective equipment for FCAW
- hazards and control measures associated with welding, including housekeeping

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare materials, select and set up the welding equipment, carry out FCAW welding and inspect for and correcting defects. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with welding using flux core arc welding process (FCAW) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Materials</b>	Carbon steel or stainless steel
<b>Prepared</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Consumables</b>	Gas or gasless wire, a range of gases
<b>Equipment</b>	Semi-automatic machines
<b>Distortion prevention</b>	Measures include preheating, setting up of jigs, fixtures, clamps, etc.
<b>Rectified</b>	Using oxy acetylene air arc equipment and grinding devices

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05048B Perform advanced welding using flux core arc welding process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials, selecting and setting up the welding equipment, carrying out advanced flux core arc welding (FCAW), inspecting for and correcting defects, and maintaining the weld records.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work is carried out on a range of structural sections and/or plate and/or pipe for general fabrication and may include low carbon steel, stainless steel, low alloy steel, etc.</p> <p>As a guide, welds produced to the standard of this unit would typically conform to Australian Standard 1554 Structural Purpose, Bureau Det Norse Verticas or equivalent.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05007C	Perform manual heating and

Prerequisite units		
		thermal cutting
	MEM05047B	Weld using flux core arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare welding materials and equipment	1.1.Welding equipment is prepared. 1.2.Appropriate welding equipment is assembled and adjusted correctly and safely. 1.3.Materials are prepared to achieve required weld specification.
2. Weld joints to code requirements using advanced FCAW	2.1.Weld requirements are interpreted correctly. 2.2.Welds are deposited correctly to specifications.
3. Assess weld quality and rectify faults	3.1.Weld joints are visually inspected against specifications. 3.2.Defects are removed using appropriate methods for the given task. 3.3.Weld records are correctly completed and maintained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- depositing fillet and butt welds correctly
- performing all weld and preparation requirements
- identifying discontinuities that do not meet standard requirements
- repairing discontinuities
- using preheat methods
- interpreting weld requirements and specifications
- entering information onto proformas and standard workplace forms
- interpreting technical drawings and weld specifications relating to advanced FCAW
- using hand and power tools to prepare and weld material using FCAW
- using measurement and numeracy skills relating to advanced FCAW and preparation
- selecting equipment and consumables appropriate to task



<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• using visual identification of faults/defects</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• in depth knowledge of the properties and characteristics of a wide range of materials</li> <li>• requirements to conform to Australian Standard AS 1554 Structural Propose, Bureau Det Norse Verticas or equivalent</li> <li>• weld procedures and requirements</li> <li>• safe welding practices</li> <li>• use and application of personal protective equipment for FCAW</li> <li>• purpose of pre-welding and/or post-welding heating and the methods of application</li> <li>• instructions, symbols, specifications including bead size, bead placement, reinforcement, weld procedure sheet</li> <li>• discontinuities in relation to standards/requirements</li> <li>• different welder identification systems such as numbering, bar coding, paint coding, letter stamps</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to carry out advanced FCAW, inspect for and correct defects, and maintain the weld records. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where</p>

<b>EVIDENCE GUIDE</b>	
	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced welding using flux core arc welding process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Welding equipment</b>	Gases, settings, electrodes and related equipment

<b>RANGE STATEMENT</b>	
	selected in accordance with welding procedure
<b>Prepared</b>	Preheating, setting up of jigs, fixtures, clamps, etc.
<b>Materials</b>	Low carbon, cast iron, stainless and low alloy steel
<b>Welds</b>	Fillet and butt in horizontal, vertical and overhead positions
<b>Appropriate methods</b>	Oxy acetylene and air act equipment, grinding devices

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM05049B Perform routine gas tungsten arc welding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing the materials and carrying out routine gas tungsten arc welding (GTAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in a maintenance or manufacturing environment where the weld quality is not required to meet an Australian Standard. Fillet and butt welds would typically be performed on low carbon/mild steels and aluminium.</p> <p>Where welding is required to meet Australian Standard 1554 General Purpose or equivalent codes, occupational health and safety regulations and/or licensing requirements, Unit MEM05019D (Weld using gas tungsten arc welding process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify weld requirements	1.1.Weld requirements are identified from job instructions. 1.2.The locations of welds are identified in accordance with standard operating procedures and job specifications.
2. Prepare materials for welding	2.1.Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1.Welding equipment is set up correctly. 3.2.Settings and consumables are selected to suit application.
4. Perform routine welding using GTAW	4.1.Safe welding practices are applied. 4.2.Materials are welded to job requirements. 4.3.Welds are cleaned to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials
- setting up welding equipment
- welding with GTAW
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- using measurement skills for joint preparation and routine GTAW

#### Required knowledge

Look for evidence that confirms knowledge of:

- preparatory requirements
- properties and characteristics of materials and consumables
- equipment and equipment settings
- fuel gas properties and applications
- post welding treatments
- weld characteristics
- safe welding practices
- use and application of personal protective equipment for routine GTAW

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform routine gas tungsten arc welding (GTAW).

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with carrying out routine gas tungsten arc welding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Materials</b>	Mild and low carbon steel
<b>Prepared</b>	Preheating, setting up jigs, fixtures, clamps, joint preparation
<b>Equipment</b>	Hoses, welding leads and gas shrouds, electrodes, gas regulator, liners, contact tips
<b>Consumables</b>	Tungsten electrodes, filler wire, shielding gas
<b>Cleaned</b>	Slag, spatter

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05050B Perform routine gas metal arc welding

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing materials and routine gas metal arc welding (GMAW).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in a maintenance or manufacturing environment where the weld quality is not required to meet an Australian Standard or equivalent. Fillet and butt welds would typically be performed on low carbon/mild steels.</p> <p>Where welding is required to meet Australian Standard 1554 General Purpose or equivalent codes, occupational health and safety regulations and/or licensing requirements, Unit MEM05017D (Weld using gas metal arc welding process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify weld requirements	1.1.Weld requirements are identified from job instructions. 1.2.Locations of welds are identified in according to standard operating procedures and job specifications.
2. Prepare materials for welding	2.1.Materials are cleaned and prepared ready for welding.
3. Prepare equipment for welding	3.1.Welding equipment is set up correctly. 3.2.Settings and consumables are selected to suit application.
4. Perform routine welding using GMAW	4.1.Safe welding practices are applied. 4.2.Materials are welded to job requirements. 4.3.Welds are cleaned to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials
- setting up welding equipment
- welding with GMAW
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instruction
- using measurement skills relating to joint preparation and routine GMAW

#### Required knowledge

Look for evidence that confirms knowledge of:

- different current and voltage settings, gas flow rates wire diameters, wire feed speed and other variables to suit typical situations.
- material and equipment preparation
- properties and characteristics of materials and consumables
- equipment and equipment settings
- fuel gas properties and applications
- post-welding treatments
- weld characteristics
- safe welding practices
- use and application of personal protective equipment for routine GMAW

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to perform routine gas metal arc welding (GMAW).
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing the materials and carrying out routine gas metal arc welding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Materials</b>	Mild and low carbon steel
<b>Prepared</b>	Preheating, setting up jigs, fixtures, clamps, joint preparation
<b>Equipment</b>	Hoses, welding leads, gas shrouds, gas regulators, liners, contact tips
<b>Consumables</b>	Filler wire, shielding gas
<b>Cleaned</b>	Slag and spatter

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Fabrication
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## MEM05051A Select welding processes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying material properties and selecting appropriate welding processes to achieve safe and effective welding outcomes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all types of welding. It includes the identification of properties and characteristics of all commonly used metals, and selection of appropriate welding techniques to ensure integrity of materials is maintained during welding processes.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify properties of commonly used metals	1.1. Materials to be welded are identified. 1.2. Characteristics and properties of commonly used materials are identified. 1.3. Uses and purposes of commonly used materials are identified. 1.4. Basic metallurgical characteristics are considered.
2. Identify and provide for welding contingencies	2.1. Information relevant to welding processes is sourced as required. 2.2. Potential contingencies are identified and solutions are considered.
3. Identify appropriate welding processes	3.1. Welding processes are identified and selected to achieve specified outcomes with selected metals. 3.2. Effects of welding processes on materials are identified. 3.3. Distortion prevention measures are identified. 3.4. Alternative joining methods for job are identified and assessed for relevancy.
4. Identify cleaning and preparation requirements	4.1. Processes for cleaning and preparing metals are identified. 4.2. Role of contaminants in welding flaws is explained. 4.3. Safety requirements for chemicals and other

ELEMENT	PERFORMANCE CRITERIA
	materials are identified and utilised in accordance with manufacturers' specifications and legislative requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- hazards and control measures associated with welding practices, including housekeeping
- safe work practices and procedures
- properties and characteristics of commonly used metals and materials
- basic metallurgy principles
- information resources
- chemical content of fumes emitted by welding processes
- uses and purposes of various metals
- distortion prevention measures for various metals

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select welding processes.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting welding processes or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Characteristics</b>	Tensile strength, grade, heat resistance, density
<b>Properties</b>	Physical properties, flammable limits, melting point
<b>Basic metallurgical characteristics</b>	Alloys and grades of metals and different types of electrodes
<b>Information</b>	Steel suppliers handbooks, welding company materials, standard operating procedures, safety documentation
<b>Welding processes</b>	<ul style="list-style-type: none"> <li>• Fusion:               <ul style="list-style-type: none"> <li>• electric arc welding</li> <li>• gas (oxy-fuel) welding</li> <li>• thermit welding</li> </ul> </li> <li>• Pressure welding processes:               <ul style="list-style-type: none"> <li>• resistance welding</li> <li>• fire or forge welding</li> <li>• friction welding</li> <li>• explosive welding</li> </ul> </li> <li>• Low temperature processes:               <ul style="list-style-type: none"> <li>• soldering</li> <li>• brazing</li> </ul> </li> <li>• Other:               <ul style="list-style-type: none"> <li>• ultrasonic welding</li> <li>• electron beam welding</li> </ul> </li> </ul>
<b>Effects</b>	Thermal expansion, heat affected zones, fume emissions, altered density, distortion
<b>Distortion prevention measures</b>	Heat treatments, consolidations
<b>Processes for cleaning and weld preparation</b>	Etching, grinding, arc gouging, thermal cutting, chemical additives, anti-corrosion treatments

**RANGE STATEMENT****Safety requirements**

- Dry and ventilated areas
- In accordance with workplace procedures
- Location away from heat risks
- Location away from incompatible substances
- Requirements for hazardous substances
- Adequate signage and labelling
- Appropriate sealing
- Routine inspections
- Emergency procedures
- Regulatory notification requirements

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Fabrication
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## MEM05052A Apply safe welding practices

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying risks associated with welding operations and implementing hazard reduction practices.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to gas and electric arc welding. It includes the identification of risks associated with welding all commonly used metals and implementation of techniques used to reduce or eliminate welding hazards.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Access and interpret OH&S information	1.1.OH&S information is obtained and interpreted. 1.2.Relevant OH&S legislation is identified. 1.3.Work related safety information is obtained and interpreted.
2. Identify risks associated with welding	2.1.Pollutants formed by welding processes are identified. 2.2.Occupational diseases and injuries which may be associated with welding are identified. 2.3.Factors associated with increased risk are identified. 2.4.Exposure levels for pollutants are identified. 2.5.Risks and potential health effects associated with specific metals are identified. 2.6.Risks and potential health effects associated with gases in welding are identified. 2.7.Other hazards of welding are identified.
3. Reduce risks associated with welding	3.1.Manual handling techniques are used. 3.2.Personal protective equipment is used correctly. 3.3.Procedures to control hazards are implemented. 3.4.Workplace safety procedures are implemented. 3.5.Workplace safety non-compliances are reported in accordance with workplace procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- sourcing and interpreting safety-related information and Material Safety Data Sheets (MSDS)
- planning and sequencing operations
- identifying workplace risks and nonconformances
- reporting workplace risks and nonconformances
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics and properties of common metals and welding materials
- effect of gas and electrical welding operations on metals
- hazards and control measures associated with gas and electrical welding, including housekeeping
- welding safety practices and procedures
- effect of various treatments on a range of commonly used metals
- use and application of personal protective equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply safe welding practices.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can



<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying safe welding practices or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**OH&S information**

- National Occupational Health and Safety Commission guidelines
- Organisational OH&S practices and procedures manuals
- Australian/New Zealand and ISO standards
- Company risk management policy
- Codes of practice
- Australian dangerous goods legislation
- Trade practices
- Occupational Health and Safety reporting requirements
- Weld procedures

**Work related safety information**

- Standard operating procedures
- Material safety data sheets (MSDSs)
- Job sheets
- Emergency procedures
- Safety standards and procedures

**Pollutants**

- Nitrogen oxides
- Ozone
- Metal fumes etc.
- Lead oxide
- Silicon oxide
- Calcium fluoride
- Calcium oxide
- Magnesium oxide
- Sodium oxide
- Potassium oxides
- Carbon dioxide
- Organics
- Iron
- Manganese
- Calcium carbonate
- Zirconium oxide
- Titanium oxide
- Hexavalent chromium

<b>RANGE STATEMENT</b>	
<b>Occupational diseases and injuries</b>	<ul style="list-style-type: none"> <li>• Eye injuries</li> <li>• Skin damage</li> <li>• Respiratory irritations</li> <li>• Chronic effects</li> <li>• Allergies</li> </ul>
<b>Factors</b>	<ul style="list-style-type: none"> <li>• Gas leakage from cylinders</li> <li>• Type of consumable and metals used</li> <li>• Type of welding processes</li> <li>• Type of electrodes</li> <li>• Welding current</li> <li>• Voltage and amperage</li> <li>• Ventilation</li> <li>• Contamination</li> <li>• Interaction of chemicals</li> <li>• Exposure levels</li> <li>• Flammability</li> </ul>
<b>Exposure levels</b>	<ul style="list-style-type: none"> <li>• Time Weighted Average</li> <li>• Short Term Exposure Limit (STEL)</li> <li>• Maximum Allowable Concentration (MAC) or Threshold Limit Value - Ceiling (TLV-C)</li> <li>• Skin Notation</li> </ul>
<b>Specific metals</b>	<ul style="list-style-type: none"> <li>• Aluminium</li> <li>• Antimony</li> <li>• Arsenic</li> <li>• Beryllium</li> <li>• Boron</li> <li>• Cadmium</li> <li>• Chromium</li> <li>• Copper</li> <li>• Cobalt</li> <li>• Iron</li> <li>• Lead</li> <li>• Lithium</li> <li>• Magnesium</li> <li>• Manganese</li> <li>• Mercury</li> <li>• Molybdenum</li> <li>• Nickel</li> <li>• Platinum</li> <li>• Selenium</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Silver</li> <li>• Thorium</li> <li>• Tin</li> <li>• Titanium</li> <li>• Tungsten</li> <li>• Vanadium</li> <li>• Zinc</li> <li>• Zirconium</li> </ul>
<b>Gases</b>	<ul style="list-style-type: none"> <li>• Acetylene</li> <li>• Argon</li> <li>• Carbon dioxide</li> <li>• Carbon monoxide</li> <li>• Helium</li> <li>• Nitrogen oxides</li> <li>• Ozone</li> <li>• Phosgene</li> <li>• Phosphine</li> <li>• Stibine</li> </ul>
<b>Other hazards</b>	<ul style="list-style-type: none"> <li>• Fluxes</li> <li>• Electro-magnetic radiation</li> <li>• Electric shock</li> <li>• Sparks</li> <li>• Spatter</li> <li>• Contaminated and coated metals</li> <li>• Gas cylinder and electrical hazards</li> <li>• Confined spaces</li> <li>• Noise</li> <li>• Chemical exposure</li> <li>• Solvents</li> <li>• Musculoskeletal, back and overuse injuries</li> <li>• Vibration</li> <li>• Dusts</li> <li>• Heat stress</li> <li>• Ultraviolet radiation</li> <li>• Airborne pollutants</li> <li>• Flammable gases</li> <li>• Infrared radiation</li> <li>• Thermal damage</li> </ul>
<b>Manual handling techniques</b>	<ul style="list-style-type: none"> <li>• Housekeeping practices</li> <li>• Lifting weight limits</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Appropriate storage</li> <li>• Use of lifting devices</li> <li>• Appropriate training</li> <li>• Hazardous materials storage standards and procedures</li> </ul>
<b>Personal protective equipment</b>	<ul style="list-style-type: none"> <li>• Respirators</li> <li>• Ear muffs</li> <li>• Protective clothing</li> <li>• Gloves</li> <li>• Boots</li> <li>• Helmets</li> <li>• Eye protection</li> <li>• Face shields</li> </ul>
<b>Procedures to control hazards</b>	<ul style="list-style-type: none"> <li>• Substituting hazardous materials with safer materials</li> <li>• Changing workplace design to eliminate hazards</li> <li>• Modifying work practices to reduce exposure</li> <li>• Using personal protective equipment</li> <li>• Using adequate and appropriate ventilation</li> </ul>
<b>Workplace safety measures</b>	<ul style="list-style-type: none"> <li>• Shielding requirements</li> <li>• Ventilation</li> <li>• General and diluted</li> <li>• Local exhaustion</li> <li>• Use of personal protective equipment</li> <li>• Checking equipment condition</li> <li>• Equipment maintenance</li> <li>• Correct operation of equipment</li> <li>• Correct voltage and electrical connections</li> <li>• Good posture</li> <li>• Fire safety, plant and equipment isolation</li> <li>• Communications with appropriate personnel</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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# MEM05053A Set and edit computer controlled thermal cutting machines

## Modification History

Single band identifier removed to clarify dual status

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting work holding fixtures/devices/tools, setting gas and nozzle controls, trialling the program, instructing the operator and replacing worn or damaged hoses, regulators, nozzles and clamps or other holding devices or tools.
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## Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to any computer or numerically controlled thermal cutting machine or process. Applications may include NC/CNC thermal cutting machines and industrial robots performing thermal cutting.</p> <p>Editing applies to identifying and accessing programs in edit mode in order to make changes associated with gas mixtures, nozzle or work piece feed speed and operational sequence. Changes are generally made in situ.</p> <p>Work is performed to established processes, practices and specifications.</p> <p>All work and work practices are performed to instructions, plans and specifications as appropriate. Technical difficulties are resolved in consultation with appropriate technical advisers. Work is carried out autonomously to predetermined standards of quality and safety.</p> <p>For setting and editing other computer controlled machines, see Unit MEM07016C (Set and edit computer controlled machines/processes). Where manual thermal cutting, gouging and shaping is required Unit MEM05008C Perform advanced manual thermal cutting, gouging and shaping should also be selected.</p>
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	<p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05007C	Perform manual heating and thermal cutting
	MEM05009C	Perform automated thermal cutting
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the
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	required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirements	1.1. Instructions/plans are understood and correctly followed.
2. Set work holding fixtures/devices/tools	2.1. Correct ancillary devices are selected and attached to machine using standard operating procedures. 2.2. Machine is prepared to accept work holding devices. 2.3. Work holding fixtures/devices/tools are set to zero or a datum using appropriate setting devices.
3. Set gas and nozzle controls	3.1. Gas and nozzle controls are set according to type and thickness of material to be cut and to minimise distortion.
4. Trial program	4.1. Program is trialled observing all safety procedures. 4.2. Sample cut is checked for compliance with specifications. 4.3. Program editing to change gas mixture, feed and operational sequence requirements is undertaken as required to ensure job conforms to specification.
5. Instruct machine operator	5.1. Operator is instructed if necessary ensuring that all safety procedures and devices are in place.
6. Replace worn or damaged nozzles, regulators and work holding devices/tools.	6.1. Where appropriate, worn or damaged nozzles, regulators and work holding devices/tools are replaced, or other corrective action is taken using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- attaching ancillary devices
- mounting work holding devices
- editing programs
- instructing machine operator on the sequence of operations
- following safety procedures
- identifying worn or damaged holding devices or fixtures and taking appropriate corrective action

**Required knowledge**

Look for evidence that confirms knowledge of:

- ancillary equipment and its applications
- procedures for attaching the ancillary device(s) to the NC/CNC machine
- work holding devices, their application and procedures for mounting them
- location of work holding fixtures/devices/tools relative to the machine zero or datum
- operating procedures
- safety features and equipment
- measuring devices/ techniques for checking the parts or product
- effects of changes to gas mixtures and nozzle or work piece speed
- the impact of changes to the sequence of operations on the part or product to be produced
- procedures for editing programs via the machine controller
- the sequence of operations of the machine/process
- the corrective action to be taken for worn or damaged tooling
- hazards and control measures associated with computer controlled machines, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to set and edit computer controlled thermal cutting machines/processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting and editing computer controlled thermal cutting machines or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for  
assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Fabrication
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## MEM05054A Write basic NC/CNC programs for thermal cutting machines

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit applies to thermal cutting machines and covers identifying computer controlled machine program elements, writing a basic program and operation sheet, and trialling the program.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit extends to writing a program to describe simple thermal cutting machine operations including cutting paths using appropriate software for machines which may incorporate single or multiple nozzles and material loaders. The program may use common M and G codes but does not include the programming of advanced operations using canned cycles and sub-routines.</p> <p>Programs are trialled and edited as necessary to adjust operation of the machine. Technical difficulties are resolved in consultation with appropriate technical advisers. Work would be undertaken autonomously using predetermined standards of quality.</p> <p>For basic programming of other computer controlled machines, see Unit MEM07018C (Write basic NC/CNC programs).</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05007C	Perform manual heating and thermal cutting
	MEM05008C	Perform advanced manual thermal cutting, gouging and shaping
	MEM05009C	Perform automated thermal cutting
	MEM05053A	Set and edit computer controlled thermal cutting machines
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify <i>basic</i> NC/CNC machine program elements	1.1.Appropriate program elements are selected for machine controller.
2. Write basic NC/CNC machine program	2.1.Engineering drawings are understood and interpreted to define basic machine function and cutting path geometry. 2.2.Coordinates are calculated for cutting path 2.3.Program is written in standard code format in accordance with standard operating procedures.
3. Write NC/CNC operation sheet	3.1.Operation sheets are produced to specification in accordance with standard operating procedures.
4. Trial program	4.1.Machine is operated in manual mode to test and prove program as required. 4.2.Program is edited if necessary to adjust operation as required. 4.3.Components are checked for conformance to specification as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- calculating coordinates of all relevant points on the part or product to be cut or welded
- writing NC/CNC program in standard code format



**REQUIRED SKILLS AND KNOWLEDGE**

- producing NC/CNC operation sheet(s)
- operating NC/CNC machine safely in manual mode
- editing NC/CNC program
- checking parts or products for conformance to specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- the elements of a basic NC/CNC program
- the function of elements in controlling the operation of an NC/ CNC machine
- type(s) of NC/CNC thermal cutting and welding machine and their applications
- thermal cutting operations controlled by program
- the cutting path(s) to be followed when cutting a part or product
- the reasons for selecting cutting path(s) and sequence of operations
- the zero point of the NC/CNC machine
- standard codes used in the writing of NC/CNC programs
- applications of standard codes in NC/CNC programming
- procedures for writing NC/CNC programs in standard code format
- procedures for completing NC/CNC operation sheets
- the information to be included in NC/CNC operation sheets
- procedures for manual operation of the NC/CNC machine
- reasons for testing and proving the NC/CNC program
- procedures for editing the NC/CNC program via the machine controller
- the effects of editing on the operation of the NC/CNC machine and the part or product to be cut
- the measuring equipment/techniques used to check for conformance to specification
- hazards and control measures associated with numerical and computer controlled machines, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform basic NC/CNC programming. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic NC/CNC programming or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Basic</b>	NC or CNC thermal cutting machines which do not require programming using canned cycles and sub-routines.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Fabrication
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## MEM06001B Perform hand forging

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using hand tools and formers, applying hand forging techniques and operating heat treatment equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to hand forging low to medium carbon and alloy steels using a variety of techniques, tools, formers and heating devices.</p> <p>For simple manual heating and bending, see Unit MEM05007C (Perform manual heating and thermal cutting).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use hand tools and formers	1.1.Hand tools and formers are correctly selected for specific forging techniques. 1.2.Hand tools and formers used correctly.
2. Apply hand forging techniques	2.1.Knowledge of drawing, swaging, bending, upsetting, spreading, punching and drifting techniques is applied to produce articles to specification. 2.2.Forging temperatures and heat specifications are adhered to for various materials. 2.3.Allowance is made for material shrinkage and oxidation 2.4.Appropriate forging technique is selected and applied.
3. Operate heating equipment	3.1.Heating equipment is set up and operated correctly. 3.2.Equipment is operated in a manner that minimises oxidation. 3.3.Heat is controlled to specified areas.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and using hand tools and formers
- applying hand forging techniques
- determining correct forging temperatures
- setting up and operating heating equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- range of hand tools, formers used in hand forging
- hand forging techniques (drawing, swaging, bending, upsetting, spreading, punching, drifting)
- how to calculate mean diameter, length, circumference
- source of information on forging temperatures
- heat specifications for various materials
- effects of and allowances for material shrinkage and oxidation
- the application, set up, and means of adjustment of a range of heating equipment
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with hand forging, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to use hand tools and formers, apply hand forging techniques and operate heat treatment equipment. Competency in this unit cannot be claimed until all

<b>EVIDENCE GUIDE</b>	
	prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with hand forging of low to medium carbon and alloy steels using a variety of techniques, tools formers and heating devices or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Hand tools and formers</b>	Flatters, set hammers, hot/cold sets, ball peen hammer, swages, etc.
<b>Hand forging techniques</b>	Drawing, swaging, bending, upsetting, spreading, punching and drifting
<b>Materials</b>	Low to medium carbon and alloy steels
<b>Heating equipment</b>	Diesel, electric and gas furnaces; coke fires and gaseous oxygen/fuel equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Forging
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## MEM06002B Perform hammer forging

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using hammer tools and formers, selecting material, and applying hammer forging techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the use of hammer forging techniques on carbon and alloy steels using various techniques, tools, formers, power hammers and heating devices.</p> <p>Equipment range does not include drop and upset machinery, vacuum furnaces or rolling and extruding mill machinery.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use hammer tools and formers	1.1.Hammer tools and formers are correctly selected for specific forging technique. 1.2.Hammer tools and formers are used correctly. 1.3.Forging machine is set up and operated correctly.
2. Apply hammer forging techniques	2.1.Appropriate hammer forging technique is selected and applied. 2.2.Defects are recognised and appropriate rectification action is taken. 2.3.Correct techniques are applied to the handling of hot metal with regard to balancing and pivoting. 2.4.Correct heating process is applied.
3. Select material	3.1.Material calculations are made using volumes and weights that include provision for oxidation and shrinkage. 3.2.Material is correctly selected for use with specific tools and formers.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using hammer tools and formers
- setting up and operating forging machines
- following job instructions, drawings, specifications
- detecting forging defects
- rectifying forging techniques
- safely handling hot metal
- correctly heating material being forged
- calculating volume and weight of material

#### Required knowledge

Look for evidence that confirms knowledge of:

- hammer forging techniques
- the set up and operation of forging machines
- techniques for handling hot metal
- oxidation/shrinkage allowances
- numerical operations and formulae for determining the volume and weight of material
- material specifications
- hazards and control measures associated with hammer forging, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to apply hammer forging techniques to carbon and alloy steels using various techniques, tools, formers, power hammers and heating devices.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with hammer forging or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Hammer tools and formers</b>	Flatters, set hammers, hot/cold sets, ball peen hammer, swages, etc.
<b>Defects</b>	Galls, fins, shrinkage, oxidation, etc.
<b>Material calculations</b>	Thermal expansion/contraction, material wastage
<b>Heating process</b>	Diesel, electric and gas furnaces; coke fires and gaseous oxygen/fuel equipment
<b>Material</b>	Low/high carbon steels, alloys, stainless steel, lead, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Forging
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## MEM06003C Carry out heat treatment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers carrying out heat treatment of materials using a variety of equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the heat treatment of ferrous and non-ferrous metals using a variety of equipment.</p> <p>Examples of applications include cast metal products, machine tooling, and forged and machined components.</p> <p>Simple heat treatment applications like annealing and/or heat/quench processes undertaken as incidental to trade work (e.g. toolmaking) are covered by Unit MEM06007B (Perform basic incidental heat/quenching, tempering and annealing).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	



<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine requirements of job	1.1.Job requirements are determined from engineering drawings, job sheet, or verbal instructions from metallurgist or supervisor.
2. Select heat treatment equipment	2.1.Appropriate equipment is selected for the required heat treatment.
3. Set up equipment	3.1.Equipment is set up according to standard operating procedures and manufacturers' instructions.
4. Work safely with hot metals	4.1.Safety clothing and personal protective equipment is used correctly according to standard operating procedures. 4.2.Emergency procedures are demonstrated according to approved safety instructions. 4.3.Safety signs and symbols are identified and understood. 4.4.Equipment is used according to specifications and

ELEMENT	PERFORMANCE CRITERIA
	standard operating procedures.
5. Heat treat material	<p>5.1. Material is treated to achieve required result and may include preparation processes.</p> <p>5.2. Material is piece or batch loaded and unloaded using equipment appropriate to the situation, according to standard operating procedures.</p> <p>5.3. Correct temperature is maintained according to standard operating procedures.</p>
6. Identify hazardous conditions	6.1. Hazards are identified and hazard control measures are implemented to maintain a safe work environment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting up and operating heat treatment equipment
- applying heat treatment
- safely loading furnace(s)

#### Required knowledge

Look for evidence that confirms knowledge of:

- work specifications
- material characteristics
- heat treatment applications, equipment and processes
- emergency procedures
- material preparation, quenching, preheating requirements
- material condition during heat treating process
- batch and/or piece loading of furnaces
- safe loading of furnaces
- hazards and control measures associated with heat treatment, including housekeeping
- use and application of personal protective equipment

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
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- |  |
|--|
| <ul style="list-style-type: none"> <li>safe work practices and procedures</li> </ul> |
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## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to work safely with hot metals to carry out heat treatment of materials.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing heat treatment or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond

<b>EVIDENCE GUIDE</b>	
	those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment</b>	Gas, electric, oil fired furnaces, vacuum furnace, induction heating, kilns, heated baths, salt baths, specialised tongs/tools and lifting equipment
<b>Material</b>	Plain carbon steels, alloy steels, non-ferrous
<b>Preparation processes</b>	Coatings and packings; preheating; soaking; quenching; tempering; annealing; normalising; carburizing; sintering

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Forging
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## MEM06004B Select heat treatment processes and test finished product

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting the appropriate process to achieve the desired result, recording and maintaining heat treatment information, and testing treated materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the heat treatment of ferrous and non-ferrous metals using a variety of equipment. Equipment range does not include drop and upset machinery, vacuum furnaces or rolling and extruding mill machinery.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM06003C	Carry out heat treatment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Heat treatment process to achieve specified result is determined using reference material, metallurgist's report, consultation with technical specialists or other appropriate personnel. 1.2.Knowledge of metal composition and effects of heat and cooling is applied to selection of appropriate process and equipment.
2. Record and maintain heat treatment information	2.1.All relevant task information is recorded according to standard operating procedures. 2.2.Information relating to equipment and processes is maintained as required.
3. Test material	3.1.Material is prepared for testing as required. 3.2.Properties of material are tested using appropriate testing equipment as required. 3.3.Heat treatment faults are identified and reported if appropriate. 3.4.Heat treatment faults are rectified where possible.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing materials for testing
- using appropriate equipment to test materials
- identifying heat treatment faults
- rectifying heat treatment faults
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, reports and other applicable reference documents
- entering routine and familiar information onto proformas and standard workplace forms
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- material characteristics and properties
- heat treatment processes
- effect of heat on material characteristics
- material preparation
- quenching, preheating, temperature requirements for different materials and processes
- types of destructive and non-destructive testing
- heat treatment faults and corrections
- hazards/control measures within the scope of this unit
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment



<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to determine the appropriate process to achieve the desired result, maintain documentation of jobs, and test the treated material. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting heat treatment processes and testing finished products or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Heat treatment process</b>	Coatings and packings, preheating, soaking, quenching, tempering, annealing, normalising, carburising, sintering
<b>Metal composition</b>	High/low carbon steel, ferrous/non-ferrous
<b>Equipment</b>	Salt baths, vacuum furnace, induction heating, kilns, gas fired furnaces etc. Equipment range does not include drop and upset machinery, vacuum furnaces or rolling and extruding mill machinery.
<b>Material</b>	Ferrous and non-ferrous metals
<b>Testing</b>	Testing includes destructive and non-destructive methods
<b>Heat treatment faults</b>	Thermal fractures, distortion, shrinkage, oxidation, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Forging
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## MEM06005B Perform drop and upset forging

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting, setting up, and operating drop and upset forging equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit includes the preparation and forging of material using drop and upset methods on a range of metals, and a range of drop forging and upset forging equipment including cold upset forging equipment.</p> <p>The material forged is to specified dimensional accuracy and finish.</p> <p>For routine, repetitive cold upset forging see Unit MEM07024B (Operate and monitor machine/process [basic])</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM06002B	Perform hammer forging

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify and select drop and upset forging equipment and tools for specific operation	1.1.Appropriate equipment is selected which accounts for size of material and procedures. 1.2.Dies and punches are correctly selected for specific operations and equipment. 1.3.Die replacement is correctly determined with regard to relief allowances, cracking, dimensions, etc.
2. Set up and operate drop and upset forging equipment	2.1.Equipment is correctly and safely set up, adjusted and operated. 2.2.Correct die setting techniques are applied in setting correct die and punch alignment. 2.3.Correct die preheating procedures are applied.
3. Prepare material	3.1.Materials are correctly prepared and heated in accordance with job requirements and/or specifications.

ELEMENT	PERFORMANCE CRITERIA
4. Drop and upset forge material	<p>4.1. Material is drop forged using the correct procedures and techniques.</p> <p>4.2. Correct lubricant is applied for die wear and forging release.</p> <p>4.3. Correct grain flow is determined.</p> <p>4.4. Galls, folds and cracks are identified and corrected.</p> <p>4.5. Correct removal of flash or fin is carried out.</p> <p>4.6. Material amounts are calculated with allowance for heat wastage and flash or fin.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- inspecting dies and preparing dies and materials
- aligning dies and punches
- replacing dies
- operating drop/upset forging equipment
- die preparation
- material preparation
- detecting and correcting defects
- removing flash or fins
- calculating material volume, weight, allowances, heat wastage, flash, fin

#### Required knowledge

Look for evidence that confirms knowledge of:

- drop or upset forging techniques
- characteristics of forging equipment
- safety work practices and procedures
- hazards and control measures associated with drop and upset forging, including housekeeping
- incorrect/correct alignment of dies, punches
- dies (preheating, preparation, lubrication, defects, conformance, replacement)

**REQUIRED SKILLS AND KNOWLEDGE**

- materials pre-heating
- relevant tools, techniques and equipment
- setting, adjusting, operating forging equipment
- features of defects in drop/upset forged articles such as, galls, folds, cracks
- ways of correcting defects
- ways of removing flash, fins from drop/upset forged articles
- calculations for material volume, weight, allowances, heat wastage, flash/fin

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform preparation and forging of material using drop and upset methods on a range of metals, and a range of drop forging and upset forging equipment including cold upset forging equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with selecting, setting up, and operating drop and upset forging equipment or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment</b>	May include: drop forging hammer/press, open die forging hammer using closed loose die or horizontal upsetting machine (heading machine)
<b>Materials</b>	May include: ferrous materials (steel) or non-ferrous material (copper, aluminium bronze)
<b>Lubricants</b>	Graphite bearing oils/greases or cellulose granules, waxes
<b>Correct removal</b>	Ejector pins, drafts in die (angle)



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Forging
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## MEM06006C Repair springs

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing spring condition, setting and resetting springs for repair, setting up and operating spring forming equipment, forming and shaping material and testing components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to forming, shaping and setting operations for springs.</p> <p>When interpretation of technical drawings is required, Unit MEM09002B (Interpret technical drawing) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM06001B	Perform hand forging
	MEM06003C	Carry out heat treatment

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess spring condition	1.1.Springs are checked for correct operation and defects are identified in accordance with standard operating procedures. 1.2.Springs suitable for rework are correctly identified. 1.3.Repair procedure is correctly identified.
2. Set and reset springs for repair	2.1.Correct stripping procedure is applied. 2.2.Setting tolerances are allowed for in set/reset of springs to specification. 2.3.Correct temperature is controlled for setting/resetting springs.
3. Set up and operate spring forming equipment	3.1.Equipment is safely set up and correctly used. 3.2.Material is correctly and safely positioned. 3.3.Forming equipment and tools are correctly selected and used for given application.

ELEMENT	PERFORMANCE CRITERIA
4. Form and shape material	4.1. Material is tapered, rolled and bent to conform with specifications. 4.2. Correct procedure is adopted for both hot and cold forming. 4.3. Allowance is made for relief and spring-back. 4.4. Material lengths are correctly determined.
5. Test components	5.1. Spring compression is determined from specifications. 5.2. Defects and dimensional accuracy are correctly determined. 5.3. Springs are correctly nested to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- correctly using tools and equipment
- following plans
- using calculations to determine material requirements
- determining repair requirements
- carrying out repairs
- following oral instruction
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- procedures for testing springs for correct operation/malfunction
- causes of deviations from specifications/defect in springs
- the effects of annealing, hardening, tempering, soaking and setting on spring operation
- repair and rework procedures for a range of spring defects
- hazards and control measures associated with the set-up and operation of spring forming equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for tapering, rolling and bending materials
- applications of both hot and cold forming processes
- allowances to be made for relief and spring-back
- procedures for recording test results
- procedures for nesting springs
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assess the spring condition, set and reset springs for repair, set up and operate spring forming equipment, form and shape material and test components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

<b>EVIDENCE GUIDE</b>	
	with spring repair or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Springs</b>	Laminated, compression/coil, plate etc.
<b>Equipment</b>	Tapering, coiling, stripping and buckling, and spring testing machines, but does not include automated spring making equipment
<b>Material</b>	Spring and/or specialised steel

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Forging
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## MEM06007B Perform basic incidental heat/quenching, tempering and annealing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing straightforward heating/quenching, tempering and annealing of ferrous and non-ferrous metals.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the heat treatment of ferrous and non-ferrous metals of various types and thicknesses by a range of methods. These may include oxy acetylene, LPG gas equipment, forge etc. used to heat/quench, temper and anneal materials to specifications.</p> <p>Work would normally cover one-off processes or processes undertaken as incidental to trade work (e.g. toolmaking, metal spinning etc.)</p> <p>For more comprehensive or complex heating treatment, Units MEM06003C (Carry out heat treatment) and MEM06004B (Select heat treatment processes and test finished product) should also be considered.</p> <p>For continuous or batch heat treatment of materials, Unit MEM07024B (Operate and monitor machine/process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job requirements are determined from engineering drawing, job sheet or verbal instructions.
2. Set up equipment for heat/quenching, tempering and annealing	2.1.Appropriate heating process and/or procedure is selected for the given job. 2.2.Equipment is set up according to standard operating procedures and manufacturers' instructions.
3. Operate heating	3.1.All safety procedures are observed.

ELEMENT	PERFORMANCE CRITERIA
equipment	3.2.Appropriate heating equipment operating procedures are followed. 3.3.Appropriate equipment adjustments are made. 3.4.Material is treated to achieve required result.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, manufacturer instructions, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- following verbal instructions
- orally reporting routine information
- selecting appropriate processes for heating/quenching, tempering, annealing
- setting up, adjusting and operating equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics and applications of heating/quenching, tempering, annealing processes
- specifications for heating, quenching, tempering, and annealing
- process for heating/quenching, tempering, annealing, different materials
- operating/adjusting heating equipment
- hazards and control measures associated with heating/quenching, tempering, annealing, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform basic incidental heat/quenching, tempering and annealing of ferrous and non-ferrous metals by a range of methods, which may include oxy acetylene, LPG gas equipment, forge, and use to heat/quench temper and anneal materials to specifications.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with heating/quenching, tempering and annealing ferrous and non-ferrous metals or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures,

EVIDENCE GUIDE	
	product and manufacturing specifications, codes, standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Heating process	Heating/quenching, tempering and annealing
Heating equipment	Oxy acetylene, LPG gas equipment, forge etc.
Material	Ferrous and non-ferrous metals of various types and thicknesses

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Forging
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## MEM06008A Hammer forge complex shapes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers forging complex shapes using a power hammer.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to open die forging of complex shapes commonly forged in the forging and fabrication areas of industry including forged bosses, heavy rings and bushes.</p> <p>Specialised methods of holding, and positioning and lifting complex forgings are covered.</p> <p>Equipment may include forging plant, diesel and gas furnaces.</p> <p>For basic use of power hammer, Unit MEM06002B (Perform hammer forging) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM06002B	Perform hammer forging

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Set up and operate forging machine	<p>1.1.The forging machine is set up and operated in accordance with standard operating procedures and specifications.</p> <p>1.2.Complex open die tooling is selected and used according to workplace procedures.</p> <p>1.3.Safe operating procedures are followed.</p>
2. Forge complex shapes and heavy parts	<p>2.1.The material to be forged is safely and correctly positioned in the forming equipment in accordance with standard operating procedures.</p> <p>2.2.Hot forgings are marked and measured as required.</p> <p>2.3.Allowance is made for material shrinkage and oxidation.</p> <p>2.4.Hammer tools and fixtures attached to power hammer are used correctly.</p> <p>2.5.Forging is checked to ensure conformance to</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>tolerances and specifications.</p> <p>2.6. Forgings are handled safely and correctly according to workplace procedures.</p>
3. Heat complex forgings	<p>3.1. Heating plant and equipment is selected appropriate to work undertaken.</p> <p>3.2. Techniques used to heat heavy and complex forgings are applied correctly.</p> <p>3.3. Post-forging heating is performed correctly and safely.</p> <p>3.4. Hot forgings are handled safely and according to workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and using measuring guides
- calculating allowance for material shrinkage and oxidation
- setting up and operating forging machine
- selecting forming tools and equipment
- positioning material
- handling materials
- selecting and setting up heating equipment
- performing heat treatment process(es) for forging

#### Required knowledge

Look for evidence that confirms knowledge of:

- hammer tools and formers and their applications
- hammer forging techniques
- numerical operations and calculations/formulae for data analysis within the scope of this unit
- tools, formers and techniques to produce a range of hammer forged articles
- procedures for measuring forged articles



**REQUIRED SKILLS AND KNOWLEDGE**

- effects of material shrinkage and oxidation on the dimensions of the forged article
- methods of overcoming/allowing for the effects of shrinkage and oxidation when hammer forging articles
- hammer punching techniques
- procedures for handling material to be hammer forged
- heating equipment and applications
- heat treatment processes for forging
- heat treatment requirements for given materials

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to hammer forge complex shapes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with hammer forging complex shapes or other units

<b>EVIDENCE GUIDE</b>	
	requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Forge</b>	<ul style="list-style-type: none"> <li>Forging on and against cold mandrels</li> <li>Hammer punching and opening of large diameter holes</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Forging
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## MEM06009A Hand forge complex shapes

### Modification History

Editorial correction to unit application to include missing band identifier and unit weight

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing intricate solid forged shapes by hand forging of different metals, using specialised techniques, tools and jigs.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to hand forging of complex shapes commonly forged in the forging and fabrication areas of industry.</p> <p>Specialised methods of holding, positioning and lifting complex forgings are covered.</p> <p>Equipment may include diesel, electric and gas furnaces, coke fires and gaseous oxygen/fuel equipment.</p> <p>For hand forging of simple shapes, Unit MEM06001B (Perform hand forging) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM06001B	Perform hand forging

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Forge complex shapes using hand tools on an anvil	<p>1.1.Task requirements for complex hand forging are identified and clarified as required.</p> <p>1.2.Material volume is correctly calculated.</p> <p>1.3.Allowances for bending, material shrinkage and oxidation are made as required.</p> <p>1.4.Hand tools and formers are selected and used correctly in accordance with standard operating procedures.</p> <p>1.5.Safe hand forging procedures are followed.</p> <p>1.6.Techniques and principles for producing complex shapes are applied correctly.</p> <p>1.7.Forging is checked to ensure conformance to tolerances and specifications.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Perform splitting and bundling on anvil	2.1. Tools and equipment are selected and used correctly. 2.2. Hand forging techniques and procedures are applied to forging and opening bundled and split sections. 2.3. Allowance is made for material shrinkage, distortion and oxidation. 2.4. Heat is applied and controlled in specified areas of the material to be forged in accordance with standard operating procedures. 2.5. Forgings are handled safely and correctly according to workplace procedures. 2.6. Forgings are checked to ensure conformance to tolerances and specifications.
3. Produce jigs and tools for complex shapes	3.1. Tools and equipment required to taper and bend materials are selected appropriate to task requirements. 3.2. Techniques for producing jigs and tools are applied correctly. 3.3. Jigs and patterns are bent and shaped to specifications. 3.4. Hand held tools are forged to cut pattern, in accordance with specifications. 3.5. Final shaping, heat treatment and sharpening is performed to specifications

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and using measuring guides
- calculating allowance for material volume, bending, shrinkage and oxidation
- selecting tools and equipment
- forging and splitting sections
- forging bundled sections and opening bundled sections
- positioning material

**REQUIRED SKILLS AND KNOWLEDGE**

- handling materials
- selecting and setting up heating equipment
- performing heat treatment process(es) for forging
- applying and controlling heat

**Required knowledge**

Look for evidence that confirms knowledge of:

- hand tools and their applications
- techniques and procedures for hand forging complex shapes
- numerical operations and calculations/formulae within the scope of this unit
- procedures for measuring forged articles
- forging temperatures and heat specifications for multiple pieces
- tools, techniques and equipment required to taper and bend materials
- effects of material shrinkage and oxidation on the dimensions of the forged article
- methods of overcoming/allowing for the effects of shrinkage and oxidation when hand forging articles
- procedures for handling forgings
- heating equipment and applications
- heat treatment processes for forging
- heat treatment requirements for given materials

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to hand forge complex shapes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with hand forging complex shapes or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and



**RANGE STATEMENT**

regional contexts) may also be included.

**Complex hand forging**

Shaping, reverse tapering, jump up section for bends

**Hand forging techniques**

Spreading, surface chasing, hot splitting

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Forging

## MEM07001B Perform operational maintenance of machines/equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers carrying out programmed safety and maintenance checks on machines/equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit mainly applies in a manufacturing setting, where routine programmed operational maintenance to machines/equipment is required. It is not intended to be used where higher level maintenance activities are performed.</p> <p>Machines/equipment range includes manual, semi-automatic and automatic machines of a stand-alone continuous production or process nature.</p> <p>This unit should not be selected when any of the following are selected: Unit MEM18055B (Dismantle, replace and assemble engineering components), Unit MEM18006C (Repair and fit engineering components), Unit MEM07005C (Perform general machining).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Undertake programmed safety and maintenance checks	1.1.Checks are undertaken safely and to prescribed procedure. 1.2.Status/report is recorded on proforma or reported orally.
2. Undertake programmed maintenance	2.1.Removal/replacement of consumable components is undertaken to prescribed procedure and instructions are followed. 2.2.Fluids and lubricants are replaced and/or topped up to prescribed schedule.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking programmed safety and maintenance checks
- undertaking programmed operational maintenance
- entering routine and familiar information onto proformas and standard workplace forms
- following routine information on written procedures
- following oral instructions
- orally reporting routine information

#### Required knowledge

Look for evidence that confirms knowledge of:

- programmed maintenance and safety check procedures for the specified machine/equipment
- recording/reporting requirements
- safe work practices and procedures
- hazards and control measures associated with operational maintenance of machines/equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform operational maintenance of machines/equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>EVIDENCE GUIDE</b>	
	knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operational maintenance of machines/equipment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating</p>

**RANGE STATEMENT**

conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Machines/equipment</b>	Manual, semi-automatic and automatic machines of a stand-alone continuous production or process nature
<b>Checks</b>	Programmed safety and maintenance checks Adjustments of a limited nature including safety guards, stops, wear pads and tool holders, nipping up glands and adjustment of scrapers and aprons
<b>Consumable components</b>	Air filters, oil wipers, grease containers, tool tips, indicator globes, fluids and lubricants, guides and limit switch actuators

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07002B Perform precision shaping/planing/slotting operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing precision shaping/planing/slotting operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of one or more of precision shaping, planing or slotting operations where achievement of the specified tolerance and finish is mandatory.</p> <p>Work is performed to drawings or sketches, specifications and instructions as appropriate.</p> <p>Precision measuring instruments, standard engineering materials and cutting tools are used.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining



Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses worn.
2. Determine job requirements	2.1. Drawings are interpreted, sequence of operations determined and tools selected to produce component to specification. 2.2. Cutting parameters are determined.
3. Perform precision shaping operations	3.1. Precision shaping operations are carried out including precision flat surfaces, shoulders, slots, keyways, angles and dovetails.

ELEMENT	PERFORMANCE CRITERIA
4. Perform precision planing operations	4.1.Precision planing operations are carried out including horizontal and vertical surfaces and angles.
5. Perform precision slotting operations	5.1.Precision slotting operations are carried out including feathered and tapered keyways, slotting internal cavities, dovetails, slotting circular surfaces and internal splines.
6. Check component for conformance to specification	6.1.Component is checked for conformance to specification using appropriate techniques, tools and equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing an operational work plan
- performing precision shaping operations:
  - flat surfaces
  - shoulders
  - slots
  - keyways
  - angles
  - dovetails
- performing precision planing operations on:
  - horizontal and vertical surfaces
- performing precision slotting operations:
  - feathered keyways
  - tapered keyways
  - slotting internal cavities
  - dovetails
  - slotting circular surfaces
  - slotting internal splines
- checking for conformance to specifications

## REQUIRED SKILLS AND KNOWLEDGE

- using precision measurement equipment
- planning and sequencing operations
- reading and interpreting information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- checking and clarifying task related information
- measuring components to specified tolerances
- performing calculations for determining cutting parameters and checking tolerances
- undertaking numerical operations within the scope of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting the chosen sequence of operations
- procedures for setting up the work piece
- tool type and geometry to achieve the required specifications on different materials
- techniques and procedures for machining the following:
  - flat surfaces
  - shoulders
  - slots
  - keyways
  - angles
  - dovetails
- planing techniques and procedures for machining:
  - horizontal and vertical surfaces
- slotting techniques and procedures for machining:
  - feathered keyways
  - tapered keyways
  - slotting internal cavities
  - dovetails
  - slotting circular surfaces
  - slotting internal splines
- appropriate techniques, tools and equipment to measure machined components
- hazards, control measures and housekeeping associated with precision shaping/planing/slotting operations
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform precision shaping/planing/slotting operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing precision shaping/planing/slotting operations or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tools**

Cutting tools, tool holders

**Cutting parameters**

Feeds, speeds, depth of cut, length of cut etc.

**Precision operations**

The use of dedicated precision measuring instruments

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units	

## Competency field

Competency field	Machine and process operations
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## MEM07003B Perform machine setting (routine)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers routine setting of machines in accordance with defined procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of non numerical control (NC)/computer numerical control (CNC) equipment. Manual, semi-automatic and automatic machines may be included. It covers the setting of a range of non-NC/CNC equipment which may be used for removing metal, bending, rolling, joining, extruding, pressing, moulding and die casting on a range of materials, including metals, plastics and fibre.</p> <p>If interpretation of drawings to Australian Standard 1100 or equivalent is required, Unit MEM09002B (Interpret technical drawing) should also be selected.</p> <p>For setting automated assembly processes, see Unit MEM07040A (Setting multistage integrated processes).</p> <p>Where setting skills for NC/CNC are required Unit MEM07015B (Set computer controlled machines/process) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07024B	Operate and monitor machine/process
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job sheets or equivalent instructions are interpreted correctly and understood.
2. Set machine	2.1.Safe working practices are understood and implemented. 2.2.Machine is set in accordance with defined procedures. 2.3.Machine is adjusted to meet specifications and



ELEMENT	PERFORMANCE CRITERIA
	operational requirements. 2.4. First-off samples are measured for compliance with specifications.
3. Instruct machine operator	3.1. Machine operator is instructed, if necessary, on sequencing settings and any required safety procedures.
4. Replace worn/damaged tooling	4.1. Worn or damaged tooling is identified and changed as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting and following job/operation sheets, standard operating procedures, specifications, safe working procedures and other applicable reference documents
- verbally conveying routine and familiar instructions
- identifying worn tools
- using hand tools for machine setting
- measuring to specified tolerances
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- sequences of machine setting operations
- techniques, tools and equipment to measure samples
- characteristics of machines/processes
- safe work practices and procedures
- tools and equipment for machine setting
- applicable machine tooling and accessories
- symptoms of tool wear
- use and application of personal protective equipment
- hazards and control measures associated with machine setting (routine)

**REQUIRED SKILLS AND KNOWLEDGE**

- strategies for conveying routine instructions

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to determine job requirements, set the machine in accordance with defined procedures, instruct the operator and replace worn or damaged tooling. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing routine machine setting or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Equivalent instructions**

Standard operating procedures, safe working procedures, operation sheets

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07004B Perform machine setting (complex)

### Modification History

Release 2 - Additional prerequisite pathway included. Outcomes remain equivalent.

### Unit Descriptor

This unit covers determining job requirements, performing complex machine setting, instructing the operator and replacing worn or damaged tooling.

### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the setting of a range of non-numerical control/computer numerical control production machines and processes. This may include manual, semi-automatic and automatic machines.</p> <p>Where numerical control/computer numerical control skills are required, Unit MEM07015B (Set computer controlled machines/processes) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM07006C	Perform lathe operations

Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07007C	Perform milling operations
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 3</b>	MEM07005C	Perform general machining
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 4</b>	MEM07005C	Perform general machining
	MEM07013B	Perform machining operations using horizontal and/or vertical boring machines
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information

Prerequisite units		
	MEM18001C	Use hand tools
<b>Path 5</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07003B	Perform machine setting (routine)
	MEM07024B	Operate and monitor machine/process
	MEM07025B	Perform advanced machine/process operation
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 6</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07003B	Perform machine setting (routine)
	MEM07024B	Operate and monitor machine/process
	MEM07026B	Perform advanced plastic processing
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 7</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07003B	Perform machine setting (routine)
	MEM07024B	Operate and monitor

Prerequisite units		
		machine/process
	MEM07027B	Perform advanced press operations
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
<b>Path 8</b>	MEM07041A	Perform production machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Job sheets or equivalent instructions are interpreted correctly and understood
2. Set machine	2.1 Safe working practices are understood and implemented 2.2 Sequence of operations is determined and machine is set accordingly 2.3 Machine is adjusted to meet specifications and operational requirements 2.4 First-off samples are measured and inspected for compliance with specifications
3. Instruct machine operator	3.1 Machine operator is instructed, if necessary, on sequencing settings and any required safety procedures
4. Replace worn/damaged tooling	4.1 Tools are changed and settings are adjusted to specification as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- interpreting information on written job sheets, instructions, standard operating procedures, safe working procedures and other applicable reference documents
- determining machine/process sequences
- verbally conveying routine and familiar instructions
- checking and adjusting machine and replacing worn or damaged tooling
- checking and clarifying task-related information
- measuring to specified tolerances

### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics and hazards of machine/process
- tooling, equipment and timing requirements of the machine's operations

- common product faults or defects and adjustments
- consequences of not instructing the machine operator
- use and application of personal protective equipment
- safe work practices and procedures
- strategies for conveying routine instructions

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to determine job requirements, set the machine, instruct the operator and replace worn or damaged tooling. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing complex machine setting or other units requiring the exercise of the skills and knowledge covered by</p>

	this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Equivalent instructions</b>	Standard operating procedures, safe working procedures, operation sheets
<b>Set</b>	The selection of gears, cams, trip dogs, pin boards or other timing mechanisms

## Unit Sector(s)

Not applicable

## Co-requisite units

Co-requisite units		

## Competency field

Machine and process operations

## MEM07005C Perform general machining

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers determining the job requirements and sequence of operations, selecting and mounting tools, performing the machining, measuring the components, and adjusting and maintaining a range of standard machine tools.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit of competency applies to the use of machinery to shape metal including lathes, mills, planers, shapers, radial arm drills, slotters and surface grinders.</p> <p>This unit has been developed to support Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in machining operations. Skills covered by this unit are generally applied in occupational and work situations associated with fitting and machining. It may also apply to other trade occupations requiring general machining skills. It may also apply in some circumstances to senior operators who have responsibility for machine set up, selection of materials and lubricants, establishment of datum points and basic marking out, and setting of speeds, feeds and other machining parameters.</p> <p>This unit has application in the MEM30205 Certificate III in Engineering - Mechanical qualification and other qualifications requiring a basic trade level of machining skills. It may also apply to MEM20205 Certificate II in Engineering - Production Technology and MEM30105 Certificate III in Engineering - Production Systems and other qualifications requiring machining skills.</p> <p>Machining is undertaken on one or more of a range of standard machine tools. Machines are not computer numerical controlled (CNC) machines.</p>
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	<p>Where machining is undertaken without undertaking any set up including mounting of tools, setting of speeds, feeds and other operational parameters then either MEM07024B Operate and monitor machine/process or MEM07025B Perform advanced machine/process operation should be selected.</p> <p>Drilling operations in this unit exclude those covered by MEM18002B Use power tools/hand held operations.</p> <p>Where substantial marking out is required, MEM12006C Mark off/out (general engineering) should be considered.</p> <p>Where precision measurement is required, MEM12003B Perform precision mechanical measurement should also be considered.</p> <p>For set-up and operation of electro-discharge (EDM) machines, refer to MEM07014B Perform electro-discharge (EDM) machining operations.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, instructions and specifications are interpreted and understood
2. Determine sequence of operations	2.1. Sequence of operations including job set-up is determined for maximum efficiency and to meet job specifications 2.2. Appropriate material is selected and datum established as required
3. Select and mount tools	3.1. Appropriate tools for job are selected, sharpened and shaped as required 3.2. Tools are mounted and positioned correctly
4. Perform machining operations	4.1. Basic marking out techniques are used where required 4.2. Machining parameters are set for job requirements and maximum tool life 4.3. Work is held or correctly clamped without damage to product, and all safety requirements are met 4.4. Machining is performed in a safe manner utilising all guards, safety procedures and personal protective clothing and equipment
5. Measure components	5.1. Components are checked with instruments or gauges appropriate to the measurement requirements to ensure compliance with specifications
6. Adjust and maintain machine	6.1. Routine maintenance and adjustments are carried out as required which may include slide and collar adjustment, cleaning and lubrication

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures which may include drawings
- following oral instruction
- planning and sequencing operations
- preparing operational work plan
- sharpening and shaping cutting tools
- identifying worn or damaged cutting tools
- correct mounting and positioning of cutting tools
- basic marking out of materials
- setting machining parameters to achieve the job requirements and maximise tool life
- using appropriate and sufficient clamping/mounting of the work piece
- using coolant/lubricant correctly
- checking for conformance to specifications
- measuring to specified tolerances and dimensions

#### Required knowledge

Required knowledge includes:

- reasons for selecting the chosen sequence of operations
- methods of work holding
- basic marking out techniques including datum points/lines
- geometry of cutting tools for a range of materials and applications
- benefits of using correctly sharpened cutting tools
- machine operation
- selection of feeds and speeds to suit a range of materials and operations within the scope of this unit
- correct methods of mounting a variety of cutting tools
- safety issues with regard to correct clamping, guards and shields
- tolerances and limits of size
- situations indicating the need for machine adjustment, lubrication and cleaning
- techniques, tools and equipment to measure materials and machined components



**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with general machining

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform general machining including responsibility for selecting and mounting tooling and setting machining parameters. Competency in this unit cannot be claimed until all prerequisites have been satisfied

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- correct job planning including identifying job requirements from drawings, instructions or specifications and sequence of operations
- identifying any required tooling, measuring equipment and accessories
- selecting and mounting required tooling
- selecting material and marking out if required
- setting machining parameters
- checking machined components for conformance to specifications.

**Context of and specific resources for assessment**

This unit has been developed to support training in and recognition of trade level competency in general machining as applied to a trade level fitting and machining, other trade or senior operator work environment. Assessment should emphasise a workplace context and procedures found in the candidate's

<b>EVIDENCE GUIDE</b>	
	<p>workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically Engineering Tradespersons - Mechanical and other persons engaged in general machining work are required to apply their machining skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing general machining or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Operations</b>	<p>Operations may include:</p> <ul style="list-style-type: none"> <li>• parallel cutting</li> <li>• slotting</li> <li>• planing</li> <li>• drilling</li> <li>• knurling</li> <li>• cutting flats</li> <li>• non-precision surface grinding operations</li> </ul>
<b>Materials</b>	Materials may include ferrous and non-ferrous
<b>Tools</b>	<p>Tools may include:</p> <ul style="list-style-type: none"> <li>• cutting tools and accessories</li> <li>• measuring devices</li> </ul>
<b>Marking out techniques</b>	Marking out techniques may include basic marking out techniques using calipers, steel rules, dividers and scribes
<b>Machining parameters</b>	<p>Machining parameters may include:</p> <ul style="list-style-type: none"> <li>• speeds</li> <li>• feeds</li> <li>• stops</li> <li>• coolant and cutting lubricants</li> </ul>
<b>Machines</b>	<p>Machines may include:</p> <ul style="list-style-type: none"> <li>• lathes</li> <li>• mills</li> <li>• planers</li> <li>• shapers</li> <li>• radial arm drills</li> <li>• slotters</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• surface grinder</li> </ul>
<b>Maintenance and adjustments</b>	Maintenance and adjustments may include: <ul style="list-style-type: none"> <li>• slide and collar adjustment</li> <li>• cleaning and lubrication</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07006C Perform lathe operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers performing machining operations on a lathe to produce components to required tolerances and specifications using all types of accessories except for the use of taper turning attachment and copy turning attachments. The unit does not cover turning of multi-start threads.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to the production of components using centre lathes and lathe accessories, precision measuring equipment and cutting tools on a range of standard engineering materials. It does not include use of a taper turning attachment, copy turning attachment or multi-start threads.</p> <p>Work is performed to established processes, practices and specifications. Cutting tools are selected using International Standard Organisation (ISO) standards or according to standard operating procedure as appropriate. Work is performed to drawings, sketches, specifications and instructions as appropriate.</p> <p>This unit has been developed for Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in lathe operations. Skills covered by this unit are generally applied in occupational and work situations associated with trade level fitting and machining work.</p> <p>This unit has application in the MEM30205 Certificate III in Engineering - Mechanical qualification and other qualifications requiring a trade level of lathe operation skills. Lathe operations may also be known as turning and the processes and associated level of skill covered by this unit are often described in industry by the term '1st Class</p>
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	Machining'.  <b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses worn
2. Determine job requirements	2.1. Drawings are interpreted, sequence of operation is determined and tooling is selected to produce component to specification
3. Mount job	3.1. Job is set up using instruments such as dial test indicators, and digital read-out equipment
4. Perform turning operations	4.1. Speeds and feeds are calculated using appropriate mathematical techniques and reference material 4.2. The full range of accessories on a centre lathe are used including three and four jaw chucks, centres, face plate, steadies, cross slide and tailstock 4.3. Turning operations are performed to specification
5. Check components for conformance with specifications	5.1. Components are checked for conformance to specification using appropriate techniques, tools and equipment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- interpreting technical drawings/specifications in relation to turning
- setting up jobs using appropriate equipment
- calculating and setting cutting feeds and speeds appropriate to the job
- checking that job is concentric and running true
- safely operating lathes
- performing turning operations

#### Required knowledge

Required knowledge includes:

- sequence of operations to achieve the job requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- tool type and geometry to achieve the required specifications and for work pieces of different materials
- numerical operations, geometry and calculations/formulae within the scope of this unit
- the consequences of varying speeds and feeds from the optimum rates calculated
- characteristics of different materials and their effects on cutting speeds and feeds
- application of lathe accessories
- techniques, tools and equipment to measure materials and machined components
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with lathe operations

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform a variety of lathe operations to specifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- determining requirements for turning job including quantity, material, measurements and tolerances
- correct job planning including identifying required measuring equipment, tooling, accessories and sequence of operations
- correct preparation of high speed steel tooling
- correct fixing of job and tooling
- calculating and setting of required speeds and feeds
- correct monitoring of turning operation
- turning undertaken to trade standard in terms of time



<b>EVIDENCE GUIDE</b>	
	<p>and responsibility for own work</p> <ul style="list-style-type: none"> <li>• undertaking correct remedial procedures for out of specification results as per enterprise procedures e.g. procedures for scrapping or reworking of components not turned to specification.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency in lathe operations as applied to a trade level fitting and machining work environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Mechanical work are required to apply their lathe operations skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated</p>

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	<p>with lathe operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Drawings</b>	Drawings include engineering drawings to AS 1100/1102
<b>Tooling</b>	<p>Tooling includes:</p> <ul style="list-style-type: none"> <li>• high speed steel, tungsten carbide, ceramic graphite and other standard cutting tools</li> <li>• boring bars</li> <li>• drills</li> <li>• reamers</li> <li>• thread chasers</li> <li>• tapping heads</li> <li>• taps</li> </ul>
<b>Instruments</b>	<p>Instruments may include:</p> <ul style="list-style-type: none"> <li>• manual and digital micrometers</li> <li>• vernier calipers</li> <li>• dial indicators</li> <li>• scribing blocks</li> </ul>
<b>Speeds and feeds</b>	<p>Speeds and feeds may include:</p> <ul style="list-style-type: none"> <li>• setting up machine</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• changing gears and speeds</li> <li>• use of lead screw</li> <li>• calculations</li> </ul>
<b>Accessories</b>	Accessories may include: <ul style="list-style-type: none"> <li>• three and four jaw chucks</li> <li>• centres</li> <li>• face plate</li> <li>• steadies</li> <li>• cross slide</li> <li>• tailstock</li> </ul>
<b>Turning operations</b>	Turning operations may include: <ul style="list-style-type: none"> <li>• manual parallel and taper turning</li> <li>• internal and external turning including boring drilling, reaming, single start thread cutting and parting off</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07007C Perform milling operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers performing machining operations on a range of milling machines to produce components to required tolerances and specifications using all types of accessories.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to a range of milling machines including vertical, horizontal and universal types, a range of precision measuring equipment and cutting tools.</p> <p>Work is performed to established processes, practices and to drawings, sketches, specifications and instructions as appropriate. Cutting tools are selected using International Standard Organisation (ISO) standards or according to standard operating procedure as appropriate.</p> <p>This unit has been developed for Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in milling operations. Skills covered by this unit are generally applied in occupational and work situations associated with trade level fitting and machining work.</p> <p>This unit has application in the MEM30205 Certificate III in Engineering - Mechanical qualification and other qualifications requiring a trade level of mill machine operation skills. Milling operations and the processes and associated level of skill covered by this unit are often described in industry by the term '1st Class Machining'.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety	1.1. Correct safety procedures are observed and

ELEMENT	PERFORMANCE CRITERIA
precautions	protective clothing and safety glasses worn
2. Determine job requirements	2.1. Drawings are interpreted, sequence of operation is determined and tooling is selected to produce component to specification 2.2. Cutting parameters are determined
3. Perform milling operations	3.1. Milling operations are carried out to produce components to specification 3.2. Operations are undertaken using conventional and/or climb milling techniques and a variety of cutters including slab, gang, end, shell, slot, form, slitting 3.3. The full range of standard accessories is used including dividing heads and rotary tables as required
4. Check components for conformance with specifications	4.1. Components are checked for conformance to specification using appropriate techniques, tools, instruments and equipment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- setting up jobs using appropriate equipment
- calculating and setting cutting feeds and speeds appropriate to the job
- interpreting drawings and job instructions/specifications
- milling components to specification
- visually and dimensionally checking components for conformance to specification

#### Required knowledge

Required knowledge includes:

- safety hazards associated with milling machines
- sequence of operations to achieve the job requirements
- cutter types and tooling geometry
- consequences of varying speeds and feeds from the optimum rates calculated

**REQUIRED SKILLS AND KNOWLEDGE**

- effects of different materials on cutting speeds and feeds
- conventional and climb milling techniques and their applications
- the application of each of the following: slab, gang, shell, slot, form and slitting
- applications requiring the use of dividing heads and rotary tables when milling components
- the procedures for using dividing heads and rotary tables on milling machines
- appropriate techniques, tools and equipment to measure milled components
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform a variety of milling operations to specifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- determining requirements for milling job including quantity, material, measurements and tolerances
- correct job planning including identifying required measuring instruments and equipment, tooling, accessories and sequence of operations
- correct fixing of job and tooling
- calculation and setting of required speed and feed
- correct monitoring of milling operation
- milling undertaken to trade standard in terms of time and responsibility for own work
- undertaking correct remedial procedures for out of specification results as per enterprise procedures e.g.



<b>EVIDENCE GUIDE</b>	
	procedures for scrapping or reworking of components not milled to specification.
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency in milling operations as applied to a trade level fitting and machining work environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Mechanical work are required to apply their milling operations skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with milling operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>

**EVIDENCE GUIDE**

	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Drawings</b>	Drawings include engineering drawings to AS 1100/1102
<b>Tooling</b>	Tooling includes: <ul style="list-style-type: none"> <li>• slab</li> <li>• gang</li> <li>• end</li> <li>• shell</li> <li>• slot</li> <li>• form</li> <li>• slitting cutters</li> </ul>
<b>Instruments</b>	Instruments may include: <ul style="list-style-type: none"> <li>• manual and digital micrometers</li> <li>• vernier calipers</li> <li>• dial indicators</li> <li>• scribing blocks</li> </ul>
<b>Cutting parameters</b>	Cutting parameters may include setting up machine, feed and speed calculations
<b>Accessories</b>	Accessories may include dividing heads and rotary tables

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07008D Perform grinding operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers determining the job requirements, observing safety precautions, selecting appropriate wheels and accessories, performing the grinding operations and checking the components for conformance to specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to grinding operations performed on surface, cylindrical and centreless grinding machines. It requires use of measuring equipment and standard engineering materials and tooling.</p> <p>Work is performed to established processes, practices and to drawings, sketches, specifications and instructions as appropriate.</p> <p>This unit has been developed for Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in grinding operations. Skills covered by this unit are generally applied in occupational and work situations associated with trade level fitting and machining work.</p> <p>This unit has application in the MEM30205 Certificate III in Engineering - Mechanical qualification and other qualifications requiring a trade level of grinding machine operation skills. Grinding operations and the processes and associated level of skill covered by this unit are often described in industry by the term '1st Class Machining'.</p> <p>Where precision mechanical measurement is required, MEM12003B Perform precision mechanical measurement should also be considered.</p>
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	<b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Job requirements are determined from specifications, and sequence of operations is determined 1.2.Correct and appropriate holding devices are selected and applied
2. Observe safety precautions	2.1.Machine guards, coolant and dust extraction devices are checked 2.2.Correct safety procedures are observed and protective clothing and safety glasses are worn
3. Select grinding wheels and accessories	3.1.Wheels are selected, balanced and dressed based on knowledge of grinding wheel structure and application 3.2.Accessories are selected to facilitate production to job specifications
4. Perform grinding operations	4.1.Grinding machine is set up and adjusted in accordance with defined procedures 4.2.Work piece is held or clamped appropriately to avoid damage 4.3.Grinding operations are performed safely, utilising all guards, safety procedures and personal protective clothing and equipment
5. Check components for conformance with specifications	5.1.Components are checked for conformance to specification using appropriate techniques, tools and equipment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- reading and interpreting information on written job instructions, procedures, specifications, charts, lists, drawings and other applicable reference documents
- checking and clarifying task related information
- preparing an operational work plan

**REQUIRED SKILLS AND KNOWLEDGE**

- planning and sequencing operations
- using precision measurement equipment within the scope of this unit
- setting up work using tools, techniques and equipment
- using coolant and dust extraction devices
- selecting and preparing grinding wheels and accessories appropriate to the grinding task
- performing and monitoring internal/external cylindrical grinding process
- clamping/mounting work pieces
- checking for conformance to specifications
- performing numerical operations and calculations within the scope of this unit

**Required knowledge**

Required knowledge includes:

- reasons for selecting the chosen sequence of operations
- the application of a range of holding devices/accessories
- reasons for selecting specific work holding devices, tools, techniques and equipment
- coolant selection/function
- standard grinding wheel shapes
- the range of abrasive materials used in grinding wheels
- factors impacting grinding wheel selection including grain size of abrasive particles, grade or strength of bond and bond material
- grinding wheel dressing tools and their application
- internal/external cylindrical grinding process
- principles of effective clamping
- grinding operations/procedures
- the function of any grinding accessories
- tools, techniques and equipment for checking components for conformance to specifications
- hazards and control measures associated with grinding operations, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to perform a variety of grinding operations to specifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:

- determining requirements for grinding job including quantity, material, measurements and tolerances
- correct job planning including identifying required measuring instruments and equipment, safety equipment, holding devices, grinding wheels, accessories and sequence of operations
- identifying guard, coolant and dust extraction requirements and checking equipment and coolant before grinding operation
- correct fixing of job
- correct monitoring of grinding operation
- undertaking grinding to trade standard in terms of time and responsibility for own work
- undertaking correct remedial procedures for out of specification results as per enterprise procedures e.g. procedures for scrapping or reworking of components not ground to specification.

### Context of and specific resources for assessment

This unit has been developed to support training in and recognition of trade level competency in grinding operations as applied to a trade level fitting and machining work environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.

The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

### Method of assessment

Typically, persons engaged in Engineering Tradesperson - Mechanical work are required to apply their grinding



**EVIDENCE GUIDE**

	<p>operations skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with grinding operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating

<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Specifications</b>	Specifications may include: <ul style="list-style-type: none"> <li>• dimensions and tolerances</li> <li>• geometry and tolerances</li> <li>• surface finish</li> </ul>
<b>Holding devices</b>	Holding devices may include: <ul style="list-style-type: none"> <li>• vices</li> <li>• clamps</li> <li>• magnetic chucks</li> <li>• face plates</li> <li>• collets</li> <li>• 3/4 jaw chuck</li> </ul>
<b>Wheels</b>	Wheels may include: <ul style="list-style-type: none"> <li>• shape</li> <li>• grit/bond composition</li> </ul>
<b>Balanced</b>	Balanced may include static and dynamic balancing
<b>Grinding machines</b>	Grinding machines may include surface, cylindrical and centreless machines

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07009B Perform precision jig boring operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing precision jig boring operations using a range of jig boring and milling machines.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to operations where a range of jig boring and milling machines, tools and accessories are used to achieve a high level of precision in finished products.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM07007C	Perform milling operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement

<b>Prerequisite units</b>		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1. Drawings are interpreted and sequence of operations is determined.
3. Select appropriate tools and accessories	3.1. Tools and accessories are selected in accordance with standard operating procedures to meet job specifications.
4. Mount job	4.1. Job is set up using instruments such as dial test indicators and digital read out equipment.
5. Perform jig boring	5.1. Holes are bored relative to coordinate position and to specification. 5.2. Rotary or tilting rotary table is used as required.

ELEMENT	PERFORMANCE CRITERIA
6. Check components for conformance to specification	6.1.Components are checked for conformance to specification using appropriate techniques, tools and equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, procedures, charts, lists, drawings and other applicable reference documents
- preparing operational work plan
- planning and sequencing operations
- selecting tools and accessories
- checking for conformance to specifications
- using precision measurement equipment
- checking and clarifying task related information
- performing numerical operations and calculations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting the chosen sequence of operations
- the application of rotary and tilting rotary tables to jig boring operations
- checks for conformance to specifications
- appropriate techniques, tools and equipment to measure machined components
- hazards and control measures associated with jig boring operations, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform precision jig boring operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing precision jig boring operations or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tools and accessories**

Cutting tools, tool attachments, charts and nomograms, rotary or tilting rotary table etc.

**Appropriate techniques**

Measuring techniques, comparison methods

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units**



## Competency field

Competency field	Machine and process operations
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## MEM07010B Perform tool and cutter grinding operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing a range of tool and cutter grinding operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the use of a range of precision measuring instruments and standard engineering materials in performing tool and cutter grinding operations. Work is performed to drawings or sketches, specifications and instructions as appropriate. Work is carried out autonomously to predetermined standards of quality and safety.</p> <p>General off hand grinding is covered by Unit MEM18002B (Use power tools/hand held operations).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining

Prerequisite units		
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Machine guards, coolant and dust extraction devices are checked. 1.2. Correct safety procedures are observed, and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1. Drawings are interpreted and sequence of operations is determined.
3. Select appropriate	3.1. Tool and cutter grinding wheels are selected, based

ELEMENT	PERFORMANCE CRITERIA
tool and cutter grinding wheels and accessories	on knowledge of grinding wheel structure, and are balanced and dressed. Accessories are selected to facilitate production to specification.
4. Perform tool and cutter grinding	<p>4.1. Universal tool and cutter grinding machines are operated to sharpen and shape the full range of tools and cutters including side and face cutters, end mill, form relieved milling cutters, flat, vee and circular form tools and hobs, slitting saws, and drills.</p> <p>4.2. Parallel internal and/or external grinding is carried out.</p> <p>4.3. Internal and/or external taper grinding is carried out to drawing specifications.</p>
5. Check components for conformance to specification	5.1. Components are checked for conformance to specification using appropriate techniques, tools and equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- checking and clarifying task related information
- preparing operational work plan
- planning and sequencing operations
- performing numerical operations and calculations within the scope of this unit
- performing safety checks of equipment
- selecting tool and cutter grinding accessories
- balancing/dressing grinding wheels
- sharpening/shaping tools and cutters
- checking components for conformance with specifications
- using precision measurement equipment within the scope of this unit

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- reasons for selecting the chosen sequence of operations
- function of coolant and dust extraction devices
- criteria for grinding wheel selection:
  - grain size of abrasive particles
  - grade or strength of bond
  - bond material
- grinding wheel dressing procedures and wheel dressing tools
- source(s) of data on tool geometry for the full range of tools and cutters, including the terminology used to describe the tool geometry
- procedures to be followed when parallel grinding on a tool and cutter grinder
- procedures to be followed when grinding tapers on a tool and cutter grinder
- tools, techniques and equipment used to check ground components for conformance with the following specifications:
  - dimensions and tolerances
  - geometry and tolerances
  - surface finish
- hazards and control measures associated with tool and cutter grinding, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform tool and cutter grinding operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing tool and cutter grinding operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

**RANGE STATEMENT**

situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tool and cutter grinding wheels**

Wheel selection criteria includes shape and grit/bond composition

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Machine and process operations

## MEM07011B Perform complex milling operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing complex milling operations, including gear cutting and helical milling of a range of materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of complex milling operations including those jobs requiring high precision or quality across a range of materials including non-standard metals and alloys. It also includes those operations requiring complex calculations.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM07007C	Perform milling operations
	MEM09002B	Interpret technical drawing



Prerequisite units		
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select milling cutters	<p>1.1. Correct milling cutter/s are selected for required operation.</p> <p>1.2. Correct cutter inserts are selected as required using International Standard Organisation standards and mounted in cutter blank.</p> <p>1.3. Cutter is mounted to machine spindle and checked for concentricity.</p>
2. Set up work	<p>2.1. Cutting parameters and steps required to mill given component/s are identified.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.2. Machine is set up with appropriate accessories as required for milling operation.</p> <p>2.3. Work is set up to required level of accuracy.</p>
3. Perform complex milling	<p>3.1. Components are milled and associated calculations are performed as necessary to achieve specification.</p> <p>3.2. Components are verified using appropriate precision measuring equipment and reworked as necessary to meet specification.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying work related information
- setting up work to the required level of accuracy
- determining cutting parameters
- selecting the correct milling cutter inserts for the cutting parameters in accordance with ISO standards
- calculating cutting parameters such as speeds, feeds and ratios
- setting up gear trains according to calculations and standard operating procedures
- safely operating milling machine
- performing complex milling operations using dividing heads and omniversal tables

#### Required knowledge

Look for evidence that confirms knowledge of:

- precision measuring equipment and their applications
- procedures for accurately setting up work
- ISO standards applicable to milling cutter inserts
- procedures for milling components such as racks and gears
- calculations, geometry and formulae relating complex milling activities

**REQUIRED SKILLS AND KNOWLEDGE**

- accessories used for complex milling
- the applications and use of omniversal tables and differential dividing heads to complex milling operations
- hazards and control measures associated with complex milling operations, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform complex milling operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing complex milling operations or other units requiring the exercise of the skills and knowledge covered by this unit.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Complex milling operations</b>	Cutting of spur gears, racks, helical gears, radial uniform rise cam lobes etc.
<b>Milling cutter/cutters</b>	Ganged cutters, form cutters etc.
<b>Set up</b>	Set up is verified using instruments such as dial test indicators and sine bars etc.
<b>Appropriate accessories</b>	Omniversal tables, differential dividing heads etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07012B Perform complex grinding operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing complex grinding operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to high precision operations such as jig grinding, grinding eccentrics, thread grinding, gauges, shapes and forms etc. Work includes the use of a range of precision measuring instruments. Grinding operations are performed on a variety of materials to achieve high levels of precision for dimensions and finish.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical

Prerequisite units		
		measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Job requirements are determined from specifications, and sequence of operations is determined.
2. Set up work	2.1. Grinding wheels are selected and dressed to form and size as required. 2.2. Work is set up to required level of accuracy as per specifications.
3. Perform complex grinding	3.1. Specialised grinding operations are performed on components such as jigs, tools and dies, eccentrics, threads, gauge shapes and forms.
4. Check components for conformance to	4.1. Components are checked for conformance to specification using appropriate techniques, tools and

ELEMENT	PERFORMANCE CRITERIA
specification	equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing an operational work plan
- dressing grinding wheel to form and size
- performing specialised grinding operations
- reading, interpreting and following information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying information
- entering routine and familiar information onto proformas and standard workplace forms
- checking for conformance to specifications
- using precision measurement equipment within the scope of this unit
- measuring components to specified tolerances
- performing numerical operations, geometry and calculations/formulae for specialised complex grinding operations

#### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting the chosen sequence of operations
- function and application of work holding devices/accessories appropriate to complex grinding
- appropriate techniques, tools and equipment to measure machined components
- hazards and control measures associated with complex grinding, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures



## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform complex grinding operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with complex grinding operations or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Grinding wheels**

Wheel selection criteria includes shape and grit/bond composition

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Machine and process operations
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## MEM07013B Perform machining operations using horizontal and/or vertical boring machines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing horizontal/vertical boring operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of boring operations, using precision measuring instruments and standard engineering materials and cutting tools.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1. Drawings are interpreted, sequence of operations is determined and tools are selected to produce component to specification using International Standard Organisation or standard operating procedures. 2.2. Cutting parameters are determined.
3. Perform boring operations	3.1. Horizontal and vertical boring operations are carried out including parallel line and taper boring, facing, turning, drilling and reaming to drawing specifications.
4. Check component for conformance to specification	4.1. Components are checked for conformance to specification using appropriate techniques, tools and equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, quality and standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- preparing an operational work plan
- selecting, mounting and positioning cutting tools
- calculating and selecting cutting parameters, including speeds and feeds
- performing horizontal and/or vertical boring operations

#### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting the chosen sequence of operations
- geometry for cutting tools for a range of materials
- calculations for determining cutting parameters and checking tolerances within the scope of this unit
- consequences of varying the speeds and feeds from the optimum rates
- procedures and techniques for carrying out horizontal and vertical boring operations
- appropriate techniques, tools and equipment to measure components
- hazards and control measures associated with horizontal and/or vertical boring, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform machining operations using horizontal and/or vertical boring machines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the performance of machining operations using horizontal and/or vertical boring machines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Horizontal boring machines</b>	Table type, floor type
<b>Vertical boring machines</b>	Double column, single column

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07014B Perform electro-discharge (EDM) machining operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing electro-discharge (EDM) machining operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of electro-discharge machining (EDM) operations and engineering materials. Work is performed to established processes, practices and standards of quality, safety and workshop procedures, and to drawings and sketches, specifications and instructions as appropriate.</p> <p>For electrode manufacture, other appropriate machining units should be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining

Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07024B	Operate and monitor machine/process
	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed, and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1. Drawings are interpreted, and sequence of operations is determined. 2.2. Correct electrode is selected to ensure finished

ELEMENT	PERFORMANCE CRITERIA
	<p>component conforms to drawing specifications.</p> <p>2.3. Electrode surface area is calculated and process parameters are set to give safe, accurate and efficient operation.</p>
3. Set up job	3.1. Job is set up relative to electrode to ensure required position is obtained.
4. Perform electro-discharge (EDM)	4.1. Electro-discharge machine is operated to produce components to drawing specifications.
5. Check components for conformance to specification	5.1. Components are checked for conformance to specification using appropriate techniques, tools and equipment.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- following relevant safety procedures
- obtaining and interpreting relevant drawings, job instructions and specifications
- selecting correct electrode to ensure that the finished product conforms to specification
- determining the coordinates of the work pieces relative to the machine datum
- calculating machining parameters necessary to achieve the safe, accurate and efficient machining of the work piece
- calculating the surface area of the electrode
- positioning work piece and electrode to enable the safe, accurate and efficient machining of the required feature(s)
- producing components to specification
- checking machined components for conformance with specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- safety hazards associated with the use of electro-discharge machines

**REQUIRED SKILLS AND KNOWLEDGE**

- the job requirements
- the sequence of operations to achieve the job requirements
- the electrode type and geometry required to achieve the specified outcome
- the effects of material to be machined on the electrode material and geometry
- the procedures for producing electrodes for the electro-discharge machining process
- the coordinates of the feature(s) to be machined
- the coordinates of the electrode relative to the machine datum
- the procedures for operating the electro-discharge machine to produce components
- the tools, techniques and equipment appropriate to the checking of machined components
- the procedures for checking machined components for conformance to specification
- the reasons for selecting the tools, techniques and equipment to be used

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform electro-discharge (EDM) machining operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working

<b>EVIDENCE GUIDE</b>	
	<p>alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with electro-discharge (EDM) machining operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Electrode</b>	Includes all types and grades of graphite electrodes
<b>Job set up</b>	Includes correct use of work holding devices and selection of EDM fluids, spark generation, cycle time, power settings, and dielectric fluids for the

**RANGE STATEMENT**

	requirement of a particular job
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07015B Set computer controlled machines/processes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers mounting work holding fixtures/devices/tools, conducting pre-start checks, setting numerical and computer controlled machines, instructing the operator and replacing worn or damaged tooling.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the setting of any computer controlled machines/processes. Applications may include NC/CNC machines and industrial robots.</p> <p>Work is performed to established processes, practices, specifications and instructions as appropriate. Technical difficulties are resolved in consultation with appropriate technical advisers.</p> <p>For setting non-computer controlled machines or processes, refer to Unit MEM07003B (Perform machine setting [routine]).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machine/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM07024B	Operate and monitor machine/process
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain job instructions	1.1.Job sheets or equivalent instructions are understood and correctly followed.
2. Mount work holding fixtures/devices/tools	2.1.Machine is prepared to accept work holding fixtures/devices/tools. 2.2.Preset tooling is mounted as required into machine/equipment. 2.3.Work holding fixtures/devices are set on machine as required using standard operating procedures. 2.4.Tool offset or datum settings are identified/verified against job sheet using standard operating procedures. 2.5.Program is loaded, selected and verified in accordance with job instructions.
3. Conduct pre-start checks	3.1.Pre-start checks are undertaken to standard operating procedures. 3.2.Correct safety procedures are observed and all safety equipment is checked for correct operation.
4. Set machine	4.1.Machine is set/adjusted to meet operational requirements and specifications. 4.2.Production samples are checked for compliance with specifications using standard operating procedures.
5. Instruct machine operator	5.1.Operator is instructed, if necessary, ensuring that all safety procedures and devices are in place.
6. Replace worn/damaged tooling	6.1.Where appropriate, preset tools are replaced, tool offsets are adjusted or other corrective action is taken using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

## REQUIRED SKILLS AND KNOWLEDGE

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- mounting work holding fixtures/devices/tooling
- mounting preset tooling
- verifying tool offsets and/or datum settings against job sheets or instructions
- loading and verifying programs
- conducting pre-start checks
- following safety procedures
- checking safety features and safety equipment for correct operation
- performing numerical operations and calculations/formulae within the scope of this unit
- setting and adjusting machines
- measuring and verifying first-off samples
- instructing machine operators on the sequence of operations
- identifying worn or damaged tooling and taking appropriate corrective action

### Required knowledge

Look for evidence that confirms knowledge of:

- work holding fixtures/devices/tools and preset tooling for different machines/processes
- procedures for mounting work holding fixtures/devices/tools
- location of work holding fixtures/devices/tools relative to the machine datum or zero
- reasons for establishing tool offsets
- the purpose of datum settings
- the source(s) of information on tool offsets and datum settings
- procedures to locate and load programs
- procedures for verifying loaded programs
- pre-start checks
- safety features of the machine/process
- the purpose and function of safety features and/or safety equipment
- machine/process setting procedures
- machine operating procedures
- adjustments that can be made to the machine/process
- the effect of adjustments on machine and operational specifications
- product or part specifications in relation to the machining process
- measuring devices for checking parts or products
- examples of worn or damaged tooling

**REQUIRED SKILLS AND KNOWLEDGE**

- the effects of worn or damaged tooling
- the corrective action for worn or damaged tooling
- hazards and control measures associated with numerical and computer controlled machines, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to set computer controlled machines/processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting computer controlled machines/processes or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07016C Set and edit computer controlled machines/processes

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting work holding fixtures/devices/tools, setting tooling offsets, trialling the program, instructing the operator and replacing worn or damaged tooling.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to any computer or numerically controlled machine or process. Applications may include NC/CNC machines and industrial robots.</p> <p>Editing applies to identifying and accessing programs in edit mode in order to make changes associated with speeds, feed and operational sequence. Changes are generally made in situ.</p> <p>Work is performed to established processes, practices and specifications. Machine operations may include welding, thermal cutting, metal cutting, forming and shaping etc.</p> <p>All work and work practices are performed to instructions, plans and specifications as appropriate. Technical difficulties are resolved in consultation with appropriate technical advisers. Work is carried out autonomously to predetermined standards of quality and safety.</p> <p>Where additional machining skills in excess of Unit MEM07005C (Perform general machining) are required then appropriate units should also be selected.</p> <p>For setting and editing computer controlled thermal cutting machines, see Unit MEM05053A (Set and edit computer controlled thermal cutting machines)</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a</p>
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	<p>Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07015B	Set computer controlled machines/processes
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07015B	Set computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirements	1.1. Instructions/plans are understood and correctly followed.
2. Set work holding fixtures/devices/tools	2.1. Correct ancillary devices are selected and attached to machine using standard operating procedures. 2.2. Machine is prepared to accept work holding devices. 2.3. Work holding fixtures/devices/tools are set to zero or a datum using appropriate setting devices.
3. Set tooling offsets	3.1. Tooling offsets are measured and recorded in machine controller.
4. Trial program	4.1. Machine is operated to produce first-off samples, observing all safety procedures. 4.2. First-off samples are checked for compliance with specifications. 4.3. Program editing to change speeds, feed and operational sequence requirements is undertaken as required to ensure job conforms to specification.
5. Instruct machine operator	5.1. Operator is instructed if necessary ensuring that all safety procedures and devices are in place.
6. Replace worn or damaged tooling	6.1. Where appropriate, tools are replaced, tool offsets are adjusted or other corrective action is taken using



ELEMENT	PERFORMANCE CRITERIA
	standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- attaching ancillary devices
- mounting work holding devices
- measuring tool offsets
- entering and verifying tool offsets
- producing and checking first-off samples
- editing programs
- instructing machine operator on the sequence of operations
- following safety procedures
- identifying worn or damaged tooling and taking appropriate corrective action

#### Required knowledge

Look for evidence that confirms knowledge of:

- ancillary equipment and its applications
- procedures for attaching the ancillary device(s) to the NC/CNC machine
- work holding devices, their application and procedures for mounting them
- location of work holding fixtures/devices/tools relative to the machine zero or datum
- reasons for establishing tool offsets
- procedures and devices for measuring tool offsets
- procedures for entering and verifying tool offset
- procedures for adjusting tool offsets
- operating procedures

## REQUIRED SKILLS AND KNOWLEDGE

- safety features and equipment
- measuring devices/ techniques for checking the parts or product
- effects of changes to cutting feeds and speeds
- the impact of changes to the sequence of operations on the part or product to be produced
- procedures for editing programs via the machine controller
- the sequence of operations of the machine/process
- examples of worn or damaged tooling
- the effects of worn or damaged tooling
- the corrective action to be taken for worn or damaged tooling
- hazards and control measures associated with computer controlled machines, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to set and edit computer controlled machines/processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not

<b>EVIDENCE GUIDE</b>	
	<p>disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting and editing computer controlled machines/processes or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

RANGE STATEMENT	

### Unit Sector(s)

Unit sector	
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### Co-requisite units

Co-requisite units		

### Competency field

Competency field	Machine and process operations
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## MEM07018C Write basic NC/CNC programs

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying computer controlled machine program elements, writing a basic program and operation sheet, and trialling the program.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit extends to writing a program to describe simple machine operations including tool paths using appropriate software for machines which may incorporate single spindles, single tools turrets, B axis angular, tool changers and component loaders of a pallet type, but excludes multiple spindles. The program may use common M and G codes but does not include the programming of advanced operations using canned cycles and sub-routines.</p> <p>Machine operations may include welding, thermal cutting, metal cutting, forming and shaping etc. Programs are trialled and edited as necessary to adjust operation of the machine. Technical difficulties are resolved in consultation with appropriate technical advisers. Work would be undertaken autonomously using predetermined standards of quality.</p> <p>If programming of advanced operations using canned cycles and sub-routines is required, see Unit MEM07019C (Program NC/CNC machining centre). Where additional machining skills in excess of Unit MEM07005C (Perform general machining) are required, then appropriate units should also be selected.</p> <p>For basic programming of computer controlled thermal cutting machines, see Unit MEM05054A (Write basic NC/CNC programs for thermal cutting machines).</p> <p><b>Band:</b></p>
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	<p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify basic NC/CNC machine program elements	1.1.Appropriate program elements are selected for machine controller.
2. Write basic NC/CNC machine program	2.1.Engineering drawings are understood and interpreted to define basic machine function and tool path geometry. 2.2.Coordinates are calculated for simple tool path or basic machining functions. 2.3.Program is written in standard code format in accordance with standard operating procedures.
3. Write NC/CNC operation sheet	3.1.Operation sheets are produced to specification in accordance with standard operating procedures.
4. Trial program	4.1.Machine is operated in manual mode to test and prove program as required. 4.2.Program is edited if necessary to adjust operation as

ELEMENT	PERFORMANCE CRITERIA
	<p>required.</p> <p>4.3.Components are checked for conformance to specification as required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- calculating coordinates of all relevant points on the part or product to be produced
- writing NC/CNC program in standard code format
- producing NC/CNC operation sheet(s)
- operating NC/CNC machine safely in manual mode
- editing NC/CNC program
- checking parts or products for conformance to specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- the elements of a basic NC/CNC program
- the function of elements in controlling the operation of an NC/ CNC machine
- machining operations
- type(s) of NC/CNC machine and their applications
- machining operations controlled by program
- the tool path(s) to be followed when producing a part or product
- the sequence of machining operations
- the reasons for selecting tool path(s) and sequence of operations
- the zero point of the NC/CNC machine
- standard codes used in the writing of NC/CNC programs
- applications of standard codes in NC/CNC programming



**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for writing NC/CNC programs in standard code format
- procedures for completing NC/CNC operation sheets
- the information to be included in NC/CNC operation sheets
- procedures for manual operation of the NC/CNC machine
- reasons for testing and proving the NC/CNC program
- procedures for editing the NC/CNC program via the machine controller
- the effects of editing on the operation of the NC/CNC machine and the part or product to be produced
- the measuring equipment/techniques used to check for conformance to specification
- hazards and control measures associated with numerical and computer controlled machines, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform basic NC/CNC programming. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic NC/CNC programming or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Basic**

Machines which incorporate single spindles, single tools turrets, B axis angular, tool changers and component loaders of a pallet type, but not multiple spindles

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07019C Program NC/CNC machining centre

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing and trialling programs for NC/CNC machining centres.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit extends to writing programs to describe machine operations including tool paths using appropriate software for machines which may incorporate single spindles, single tool turrets, tool changers, B axis angular, component loaders of the pallet type etc., but excludes multiple spindles and multiple axis. The program may use common M and G codes and includes the programming of advanced operations, using canned cycles and sub-routines. Programs are trialled and edited as necessary to adjust operation of centre. Technical difficulties are resolved in consultation with appropriate technical advisers.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify basic NC/CNC machine program elements	1.1.Appropriate program elements are selected for machine controller.
2. Write basic NC/CNC machine program	2.1.Engineering drawings are understood and interpreted to define machine function and tool path geometry. 2.2.Coordinates calculated as required for tool path or machine functions. 2.3.Advanced operations using canned cycles and sub-routines are selected and applied appropriately. 2.4.Program is written in standard code format in accordance with standard operating procedures.
3. Write NC/CNC operation sheet	3.1.Operation sheets are produced to specification in accordance with standard operating procedures which includes appropriate Australian standard where required.
4. Trial program	4.1.Machine is operated in manual mode to test and prove program. 4.2.Program is edited if necessary to adjust operation. 4.3.Components are checked to conform to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- interpreting engineering drawings, specifications and instructions
- calculating coordinates of all relevant points on the part or product to be produced
- writing NC/CNC program in standard code format and incorporating, where appropriate, canned cycles and sub-routines
- producing NC/CNC operation sheet(s)
- operating NC/CNC machine in manual mode
- editing NC/CNC program
- checking parts or products produced for conformance with specifications

### Required knowledge

Look for evidence that confirms knowledge of:

- elements of an NC/CNC program
- the function of elements in controlling the operation of an NC/ CNC machine
- machining operations to be performed in the manufacture of the given part or product
- the appropriate type(s) of NC/CNC machine to perform the required machining operations
- the machining operations to be controlled by the program to be written
- the tool path(s) to be followed when producing the part or product
- the sequence of machining operations to be programmed
- reasons for selecting the chosen tool path(s) and sequence of operations
- the zero point of the NC/CNC machine
- the canned cycles and sub-routines accessible in the particular NC/CNC machine
- the application of each canned cycle and sub-routine available
- the canned cycles and/or sub-routines to be used in the NC/CNC program
- reasons for selecting the chosen canned cycles and/or sub-routines
- standard codes used in the writing of NC/CNC programs
- applications of standard codes in NC/CNC programming
- procedures for writing NC/CNC programs in standard code format
- procedures for completing NC/CNC operation sheets
- the information to be included in NC/CNC operation sheets
- relevant Australian standards
- procedures for manual operation of the NC/CNC machine
- the reasons for testing and proving the NC/CNC program
- the procedures for editing the NC/CNC program via the machine controller

**REQUIRED SKILLS AND KNOWLEDGE**

- the effects of editing on the operation of the NC/CNC machine and the part or product to be produced
- the specifications of the part or product
- the measuring equipment/techniques to be used to check for conformance with specifications

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to program a NC/CNC machining centre. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with programming a NC/CNC machining centre or other units requiring the exercise of the skills and knowledge covered by this unit.



**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07020C Program multiple spindle and/or multiple axis NC/CNC machining centre

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying NC/CNC machine program elements, writing and trialling a machine program for multiple spindle and/or multiple axis NC/CNC machining centres, and preparing an operation sheet.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit extends to writing programs to describe machine operations including tool paths using appropriate software for machines which include multiple spindles and/or multiple axis/B axis angular, multiple tool turrets, tool changers and may include component loaders of a pallet type etc.</p> <p>The program may use common M and G codes and include the programming of advanced operations, using canned cycles and sub-routines. Programs are trialled and edited as necessary to adjust operation of centre. Technical difficulties are resolved in consultation with appropriate technical advisers. Work would be undertaken autonomously using predetermined standards of quality.</p> <p>Where machining skills in excess of MEM07005C (Perform general machining) are required, then appropriate units should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07019C	Program NC/CNC machining centre
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07019C	Program NC/CNC machining centre

Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify NC/CNC machine program elements	1.1.Appropriate program elements are selected for machine controller.
2. Write NC/CNC machine program	2.1.Engineering drawings are understood and interpreted to define machine function and tool path geometry. 2.2.Coordinates are calculated as required for tool path or machine functions. 2.3.Advanced operations using canned cycles and sub-routines are selected and applied appropriately. 2.4.Program is written in standard code format in accordance with standard operating procedures.

ELEMENT	PERFORMANCE CRITERIA
3. Write NC/CNC operation sheet	3.1.Operation sheets are produced to specification in accordance with standard operating procedures which includes appropriate Australian standard where required.
4. Trial program	4.1.Machine is operated in manual mode to test and prove program. 4.2.Program is edited if necessary to adjust operation. 4.3.Components are checked to conform to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- calculating coordinates of all relevant points on the part or product to be produced
- writing NC/CNC program in standard code format and incorporating, where appropriate, canned cycles and sub-routines
- producing NC/CNC operation sheet(s)
- operating NC/CNC machine in manual mode
- editing NC/CNC program
- checking parts or products produced for conformance with specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- elements of an NC/CNC program
- the function of elements in controlling the operation of an NC/ CNC machine
- machining operations to be performed in the manufacture of the given part or product
- the appropriate type(s) of NC/CNC machine to perform the required machining operations

## REQUIRED SKILLS AND KNOWLEDGE

- the machining operations to be controlled by the program to be written
- the tool path(s) to be followed when producing the part or product
- the sequence of machining operations to be programmed
- reasons for selecting the chosen tool path(s) and sequence of operations
- the zero point of the NC/CNC machine
- the canned cycles and sub-routines accessible in the particular NC/CNC machine
- the application of each canned cycle and sub-routine available
- the canned cycles and/or sub-routines to be used in the NC/CNC program
- reasons for selecting the chosen canned cycles and/or sub-routines
- standard codes used in the writing of NC/CNC programs
- applications of standard codes in NC/CNC programming
- procedures for writing NC/CNC programs in standard code format
- procedures for completing NC/CNC operation sheets
- the information to be included in NC/CNC operation sheets
- relevant Australian standards
- procedures for manual operation of the NC/CNC machine
- the reasons for testing and proving the NC/CNC program
- the procedures for editing the NC/CNC program via the machine controller
- the effects of editing on the operation of the NC/CNC machine and the part or product to be produced
- the specifications of the part or product
- the measuring equipment/techniques to be used to check for conformance with specifications
- hazards and control measures associated with numerical and computer controlled machines, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to program multiple spindle and/or multiple axis NC/CNC machining centres. Competency in this unit cannot be claimed until all prerequisites have been

<b>EVIDENCE GUIDE</b>	
	satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with programming multiple spindle and/or multiple axis NC/CNC machining centres or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Machine and process operations
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## MEM07021B Perform complex lathe operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up work, selecting and preparing tooling and performing complex turning operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to complex, difficult or non-standard turning e.g. single-start and multi-start thread cutting, internal blind hole thread cutting, eccentrics, copy and taper turning, counterbalancing work on face plates, mandrel work, trepanning, heavy (multi-tonne) shafts etc. requiring high precision or quality using a range of materials including non-standard metals and alloys.</p> <p>Work would be performed autonomously using predetermined standards of quality and safety.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07005C	Perform general machining

Prerequisite units		
	MEM07006C	Perform lathe operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine sequence of operations	1.1. Sequence of operations including job set-up is determined for maximum efficiency and to meet job specifications.
2. Set up work on lathe	2.1. Work is set up on the lathe to required level of accuracy using precision instruments such as dial test

ELEMENT	PERFORMANCE CRITERIA
	<p>indicators etc.</p> <p>2.2. Work piece is balanced as required when using face plates to ensure accuracy in machining.</p> <p>2.3. Work piece is set up to ensure that work piece is free of distortion following completion of machining.</p>
3. Select and prepare tooling	<p>3.1. Tooling, accessories and consumables are selected appropriate to task, specifications and material.</p> <p>3.2. Where necessary, cutting tool modifications required to perform complex turning operations are determined.</p> <p>3.3. Tooling and accessories are prepared and modified as required.</p> <p>3.4. International Standard Organisation standards for cutting tools or other appropriate standards to suit cutting parameters are applied as necessary.</p>
4. Perform complex turning	<p>4.1. Speeds and feeds are correctly calculated using appropriate mathematical techniques and reference material.</p> <p>4.2. Complex turning is undertaken to specifications and workplace procedures.</p> <p>4.3. Work piece is measured and verified to be in accordance with specification using precision measuring equipment.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting up work to the required level of accuracy using appropriate precision measuring equipment
- setting and supporting work to avoid distortion on release of clamping devices
- selecting correct cutting tools or inserts as appropriate to turning operation
- selecting and using appropriate feeds and speeds
- performing complex turning operations - counter balancing work on face plates:

**REQUIRED SKILLS AND KNOWLEDGE**

- mandrel work
- trepanning
- heavy (multi-tonne) shafts
- calculating cutting parameters, speeds and feeds
- reading, interpreting and following information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- entering routine and familiar information onto proformas and standard workplace forms
- checking for conformance to specifications
- using precision measurement equipment
- measuring components to specified tolerances
- performing numerical operations, geometry and calculations/formulae within the scope of this unit
- following oral instructions
- orally reporting information

**Required knowledge**

Look for evidence that confirms knowledge of:

- precision measuring equipment and measuring techniques within the scope of this unit
- reasons for selecting different measuring equipment
- procedures for accurately setting up work for a variety of techniques
- ISO or other standards applicable to cutting tool inserts
- cutting parameters for the given task
- feeds and speeds for complex turning operation(s)
- formulae and data relating to feeds and speeds
- techniques and procedures for carrying out the following turning operations:
  - single-start thread cutting
  - multi-start thread cutting
  - internal blind hole thread cutting
  - eccentrics
  - copy turning
  - taper turning
- techniques and procedures for carrying out the following turning operations:
  - counter balancing work on face plates
  - mandrel work
  - trepanning

**REQUIRED SKILLS AND KNOWLEDGE**

- heavy (multi-tonne) shafts
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform complex lathe operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing complex lathe operations or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be

**EVIDENCE GUIDE**

	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Lathe</b>	Applicable to all classes of lathes used for complex turning operations
<b>Tooling</b>	Cutting tools, form tools, boring bars, drills, reamers, thread chasers, tapping heads, taps etc.
<b>Complex turning</b>	May include single-start and multi-start thread cutting, internal blind hole thread cutting, eccentrics, copy and taper turning, counterbalancing work on face plates, mandrel work, trepanning, heavy (multi-tonne) shafts etc.



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07022C Program CNC wire cut machines

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing and trialling a program for a range of CNC wire cut machines. Programming includes 2 axis tool paths, 4 axis conical cutting, and auto multi-cavity work pieces.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit extends to programming a range of CNC wire cut machines. Programming includes 2 axis tool paths, 4 axis conical cutting, and auto multi-cavity work pieces. Technical difficulties are resolved in consultation with appropriate technical advisers. Work is carried out autonomously using predetermined standards of quality and safety.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Write program	<p>1.1.Engineering drawings are understood and interpreted to define optimum tool path geometry.</p> <p>1.2.Tool path is programmed using advanced operations, canned cycles and sub-routines or other appropriate sub-routines within system.</p> <p>1.3.Program is written in standard code format, and confirmed and edited as necessary using appropriate routine and standard operating procedures.</p> <p>1.4.Program is stored in accordance with standard operating procedures.</p> <p>1.5.Operation sheet is produced to standard operating procedures.</p>
2. Trial program	<p>2.1.Program is downloaded, and machining parameters that may include wire offset, wire speed, power settings are selected.</p> <p>2.2.Machine is prepared, work piece are loaded and aligned, datum and reference points are established in accordance with standard operating procedures.</p> <p>2.3.Machine is operated in appropriate mode to test and prove program, work piece positioning.</p> <p>2.4.Finished components are checked for conformance with drawing specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- interpreting drawings, specifications and instructions
- calculating coordinates of all relevant points on the part or product to be produced
- storing programs
- producing NC/CNC operation sheet(s)
- downloading and verifying NC/CNC program
- setting machine parameters
- mounting work holding fixtures/ devices/tools
- testing and proving NC/CNC program
- checking parts or products produced for conformance with specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- the operations to be controlled by the program to be written
- the tool path(s) to be followed when producing the part or product
- the sequence of operations to be programmed
- the reasons for selecting the chosen tool path(s) and sequence of operations
- the zero point of the wire cut machine
- the canned cycles and sub-routines accessible in the particular NC/CNC machine
- the application of each canned cycle and sub-routine available
- where appropriate, the canned cycles and/or sub-routines to be used in the NC/CNC program
- the reasons for selecting the chosen canned cycles and/or sub-routines
- the standard codes used in the writing of NC/CNC programs
- the applications of standard codes in NC/CNC programming
- procedures for writing NC/CNC programs in standard code format
- procedures for storing NC/CNC programs
- procedures for completing NC/CNC operation sheets
- the information to be included in NC/CNC operation sheets
- procedures for downloading NC/CNC programs
- procedures for verifying downloaded NC/CNC programs
- the machining parameters that may be entered into the machine controller
- the effect of varying the machining parameters on the product or part produced
- work holding fixtures/devices/tools
- procedures for mounting work holding fixtures/devices tools
- the location of the required work holding fixtures/devices/tools relative to the

**REQUIRED SKILLS AND KNOWLEDGE**

- machine datum or zero
- purpose of datum setting
- pre-start checks
- safety features and equipment of the NC/CNC machine
- the purpose and function of the safety features and/or equipment
- the machine mode appropriate to the testing and proving of the NC/CNC program and the checking of the position of the work piece
- the procedures to be followed when using the machine in this mode
- the relative position of the work piece to the machine datum or zero
- the specifications of the part or product
- the measuring equipment/techniques to be used to check for conformance to specification

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform programming of CNC wire cut machines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with programming of CNC wire cut machines or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Program</b>	Includes setting of speeds, tolerances, taper angles, macros, nesting tool paths, chained linear tool paths and differential profiles

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07023C Program and set up CNC manufacturing cell

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers programming operations, setting up the cell and testing the operation of the cell.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit extends to CNC machines and associated integrated equipment/robots used in flexible manufacturing cell and other advanced operations. This may include the use of multi-spindle machines, 4 and 5 axis machines and pallet loaded machining centres. Work is performed to predetermined standards, specifications and quality.</p> <p>Where machining skills in excess of Unit MEM07005C (Perform general machining) are required, then appropriate units should also be selected. Unit MEM12003B (Perform precision mechanical measurement) should also be accessed when precision measurement skills are required.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07019C	Program NC/CNC machining centre
	MEM07020C	Program multiple spindle and/or multiple axis NC/CNC machining centre
	MEM07024B	Operate and monitor machine/process
	MEM07028B	Operate computer controlled machines/processes
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
<b>Path 2</b>	MEM07005C	Perform general machining
	MEM07006C	Perform lathe operations
	MEM07007C	Perform milling operations
	MEM07015B	Set computer controlled machines/processes
	MEM07016C	Set and edit computer controlled machines/processes
	MEM07018C	Write basic NC/CNC programs
	MEM07019C	Program NC/CNC machining centre
	MEM07020C	Program multiple spindle and/or

Prerequisite units		
		multiple axis NC/CNC machining centre
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Program operations	1.1.Engineering drawings and manufacturing specifications are interpreted and understood to determine equipment required. 1.2.Equipment/cell schedule is programmed. 1.3.Controllers are linked for integration.
2. Set up cell	2.1.Manufacturing cell machines and equipment are configured to meet production specifications. 2.2.Tooling and work holding devices are installed and adjusted to meet specifications.

ELEMENT	PERFORMANCE CRITERIA
3. Test cell operation	3.1. Cell is operated and adjusted to produce components to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting relevant drawings, specifications and instructions
- loading/downloading NC/CNC programs into the individual machine controllers
- writing NC/CNC programs
- linking machine controllers of NC/ CNC machines and transfer devices
- positioning machines and equipment to optimise manufacturing cell performance
- installing and adjusting tooling and work holding devices
- operating manufacturing cell
- checking part or product for conformance with specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- the operations to be performed in producing the given part or product
- the appropriate type(s) of NC/CNC machine to perform the required machining operations
- the appropriate means of part or product transfer between machines
- the reasons for selecting the chosen equipment and machinery
- the NC/CNC programs for use in each of the cell components
- the sequence of machining and transfer operations
- the means of coordinating the operations of all components within the cell
- the communication requirements between components of the cell
- the methods of linking machine controllers
- the precautions to be taken when linking machine controllers
- the procedures for linking machine controllers can be given
- the specifications of the part or product to be produced
- the optimum physical relationship between the machines and equipment within the cell

**REQUIRED SKILLS AND KNOWLEDGE**

- the reasons for selecting this configuration of machines and equipment
- the appropriate tooling for each component of the cell
- the reasons for tooling selection
- the appropriate work holding devices for each component of the cell
- the reasons for selecting the chosen work holding devices
- the effects of adjustments to tooling and/or work holding devices on the part or product specifications
- operating procedures for the manufacturing cell
- the measurements to be taken to check the part or product for conformance to specification
- the techniques/equipment to be used to measure the part or product
- the effect of adjustments on cell performance
- the causes of non-essential dwell times
- action to be taken to minimise dwell times
- hazards and control measures associated with CNC manufacturing cells

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to program and set up CNC manufacturing cell. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with programming and setting up CNC manufacturing cells, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07024B Operate and monitor machine/process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers obtaining the job instruction, conducting the pre-start checks, and operating and monitoring the machine or process.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of production operations or continuous processes. The work is performed in accordance with clear step-by-step instructions and procedures documented on job sheets or similar process instruction documents. Operational adjustments to the machine or process by the operator are made using external controls. Basic operation (excluding setting and tool adjustments) of CNC machines is covered by this unit.</p> <p>Where production packaging and labelling of the finished goods or product is required, Unit MEM11006B (Perform production packaging) should be considered.</p> <p>This unit should not be selected with any of the following units unless the skills of this unit are being applied to an additional and different type of machine and or process: Unit MEM04001B (Operate melting furnaces), Unit MEM04002B (Perform gravity die casting), Unit MEM04003B (Operate pressure die casting machine), Unit MEM04006B (Operate sand moulding and core making machines), Unit MEM06001B (Perform hand forging), Unit MEM06002B (Perform hammer forging), Unit MEM08001B (Perform wire, jig and barrel load/unload work), Unit MEM08004B (Finish work using wet, dry and vapour deposition methods), Unit MEM08008B (Operate and control surface finishing waste treatment process)</p>
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	<b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain job	1.1.Job sheets or equivalent instructions are interpreted

ELEMENT	PERFORMANCE CRITERIA
instructions	correctly.
2. Conduct pre-start checks	2.1.Pre-start checks are undertaken to standard operating procedure. 2.2.Safety procedures are observed and all safety equipment is checked for correct operation.
3. Operate machine/process	3.1.Machine/process is started up safely and correctly in accordance with standard operating procedures. 3.2.Machine/process is operated in accordance with job instructions or standard operating procedures. 3.3.Components/feed stock are loaded and maintained consistent with production requirements. 3.4.Machine/process output is unloaded safely to standard operating procedures, as required. 3.5.Machine/process output is handled and stored in a manner not likely to cause damage, as required. 3.6.Production data is recorded to standard operating procedures.
4. Monitor machine/process	4.1.Machine/process is monitored for safe and correct operation, deviations and faults are identified and reported in accordance with standard operating procedures. 4.2.Emergency procedures are understood and followed in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- following job sheets, standard operating procedures and other applicable workplace forms
- manual handling
- following oral instructions
- entering routine and familiar information onto proformas and standard workplace forms

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>orally reporting routine information</li> <li>identifying deviations and faults in machine operation/process</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>pre-start checks</li> <li>machine/process start-up and unloading procedures</li> <li>component/feed stock levels to ensure continuous process</li> <li>production recording and reporting requirements</li> <li>types of product fault/deviations</li> <li>consequences of improper handling and storing of finished work</li> <li>procedures to be followed in emergency situations</li> <li>use and application of personal protective equipment</li> <li>safe work practices and procedures</li> <li>hazards and control measures associated with operating and monitoring machine/process</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to obtain the job instruction, conduct the pre-start checks, and operate and monitor the machine or process.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating and monitoring machine/process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Pre-start checks</b>	Condition of machine before operation
<b>Machine/process</b>	Machines and processes used in pressing, punching, plastic moulding, extruding, bending,

RANGE STATEMENT	
	joining, rolling, forming, drawing, metal removal, pickling, cylinder filling, printing, painting etc.
Production data	Production schedules, job sheets, checklists

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Machine and process operations
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## MEM07025B Perform advanced machine/process operation

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing advanced operation and monitoring of a machine or process and recognising and rectifying deviations and faults in the product/output, raw material or feed stock, tooling and machine/process.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to operations where the output of the machine/process can be varied at the discretion of the operator and where recognition/rectification skills are applied based upon product/material/process knowledge to achieve specified outcomes. Deviations and faults of the machine, raw material, process equipment and process are recognised and rectified in accordance with standard operating procedures in order to meet the specification.</p> <p>Where interpretation of a technical drawing to Australian Standard 1100/1102 or equivalent is required, unit MEM09002B (Interpret technical drawing) should also be selected.</p> <p>When production packaging and labelling of the finished goods or product is required, then Unit MEM11006B (Perform production packaging) should also be considered.</p> <p>Where diagnosis and rectification of advanced plastic processes are required, then unit MEM07026B (Perform advanced plastic processing) should be considered.</p> <p>Where diagnosis and rectification of advanced press operations are required, unit MEM07027B (Perform advanced press operations) should be considered.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07024B	Operate and monitor machine/process
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, job instructions and specifications are interpreted and task requirements are understood including machine/process selection and settings.
2. Observe safety precautions	2.1. Safety equipment and guards are checked for correct position and operation.
3. Conduct pre-start checks	3.1. Programmed operational maintenance is undertaken to standard operating procedures. 3.2. Pre-start checks are undertaken to standard operating procedures. 3.3. Equipment, raw material and tooling are verified to match task requirement.
4. Operate machine/process	4.1. Machine/process is started up safely and correctly. 4.2. Machine/process is operated in accordance with job instructions or standard operating procedures. 4.3. Components/feed stock is loaded and maintained consistent with production requirements. 4.4. Machine/process output is unloaded safely to standard operating procedure as required. 4.5. Machine/process output is handled and stored in a manner not likely to cause damage as required. 4.6. Production data is recorded to standard operating procedures.
5. Monitor machine/process	5.1. Machine/process is monitored for safe and correct operation. 5.2. Emergency procedures are understood and followed in accordance with standard operating procedures.
6. Recognise and rectify deviations and faults in product/output	6.1. Product faults/deviations are recognised from standard operating procedures, job sheets or other documentation. 6.2. Product faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation and may be achieved by adjustment of machine/process settings within parameters.
7. Recognise and rectify	7.1. Raw material faults/deviations are recognised from



ELEMENT	PERFORMANCE CRITERIA
deviations and faults with raw material/feed stock	<p>standard operating procedures, job sheets or other documentation.</p> <p>7.2.Raw material faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>
8. Recognise and rectify deviations and faults in process equipment	<p>8.1.Process equipment faults/deviations are identified against specifications and reported to standard operating procedure.</p> <p>8.2.Process equipment faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>
9. Recognise and rectify deviations and faults in machine/process	<p>9.1.Machine/process faults/deviations are recognised from standard operating procedures, job sheets or other documentation.</p> <p>9.2.Machine/process faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications, standard operating procedures and other standard workplace documents. May include drawings
- undertaking manual handling
- following job/process instructions
- determining required adjustments to process
- following oral instruction
- entering routine and familiar information onto proforma and standard workplace forms
- checking and clarifying task-related information
- orally reporting routine information
- identifying and rectifying faults/deviations in raw material, product, process and equipment

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- job requirements
- documentation requirements
- pre-start checks
- machine/process start-up and unloading procedures
- reasons and procedures for programmed operational maintenance
- component/feed stock levels to ensure continuous process
- production recording and reporting requirements
- types of raw material, product, process and equipment fault/deviations and corrective actions
- procedures to be followed in emergency situations
- consequences of improper handling and storing of finished work
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with advanced machine/process operation

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to conduct the pre-start checks, operate and monitor the machine or process and recognise and rectify deviations and faults in the product/output, raw material or feed stock, tooling and machine/process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced machine/process operation or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Machine/process</b>	Machines/processes used in pressing, punching, plastic moulding, extruding, bending, joining, rolling, forming, drawing, metal removal, pickling, cylinder filling, printing, painting etc.
<b>Faults/deviations</b>	Deviations and faults of the machine, raw material, process equipment and process

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07026B Perform advanced plastic processing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing products using advanced plastic processing equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of plastic, rubber processing including injection, blow moulding, processing of fibre reinforced composites, extrusion, thermoforming, vacuum forming, foaming etc.</p> <p>This unit relates to operations where the output of the machine/process can be varied at the discretion of the operator and where recognition/rectification skills are applied based upon product/material/process knowledge to achieve specified outcomes.</p> <p>Where interpretation of a technical drawing to Australian Standard 1100/1102 or equivalent is required, Unit MEM09002B (Interpret technical drawing) should also be selected. When production packaging and labelling of the finished goods or product is required, then Unit MEM11006B (Perform production packaging) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07024B	Operate and monitor machine/process
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, job instructions and specifications are interpreted and task requirements are understood

ELEMENT	PERFORMANCE CRITERIA
	including machine/process selection and settings.
2. Observe safety precautions	2.1.Safety equipment and guards are checked for correct position and operation.
3. Conduct pre-start checks	3.1.Programmed operational maintenance is undertaken to standard operating procedures. 3.2.Pre-start checks are undertaken to standard operating procedures. 3.3.The match of task requirements against equipment, raw material and tooling is verified.
4. Operate machine/process	4.1.Machine/process is started up safely and correctly. 4.2.Machine/process is operated in accordance with job instructions or standard operating procedures. 4.3.Components/feed stock are loaded and maintained consistent with production requirements. 4.4.Machine/process output is unloaded safely to standard operating procedures. 4.5.Machine/process output is handled and stored in a manner not likely to cause damage, as required. 4.6.Production data is recorded to standard operating procedures.
5. Monitor machine/process	5.1.Machine/process is monitored for safe and correct operation. 5.2.Emergency procedures are understood and followed in accordance with standard operating procedures.
6. Recognise and rectify deviations and faults in product/output	6.1.Product faults/deviations such as short shots, warped mouldings and dimensional errors are recognised from standard operating procedures, job sheets or other documentation. 6.2.Product faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation and may be achieved by adjustment of machine/process settings within parameters.
7. Recognise and rectify deviations and faults with raw material/feed stock	7.1.Raw material faults/deviations such as contamination, colour variation are recognised from standard operating procedures, job sheets or other documentation. 7.2.Raw material faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.
8. Recognise and rectify	8.1.Tooling faults/deviations resulting in blemishes,

ELEMENT	PERFORMANCE CRITERIA
deviations and faults in tooling	missing detail etc. are identified against specification and reported to standard operating procedure. 8.2.Tooling faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.
9. Recognise and rectify deviations and faults in machine/process	9.1.Machine/process faults/deviations such as short shots, burn marks, distortion etc. are recognised from standard operating procedures, job sheets or other documentation. 9.2.Machine/process faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- checking for conformance to specifications
- checking and clarifying task-related information
- reading, interpreting and following information on written job instructions standard operating procedures, charts, lists and other standard workplace documents
- following verbal instructions
- orally reporting routine information
- entering routine and familiar information onto proformas and standard workplace forms
- checking safety equipment and guards
- performing programmed operational maintenance
- completing pre-start checks
- checking equipment, raw material and tooling for serviceability
- starting, operating and shutting down machine/process
- loading components/feed stock
- unloading machine/process output
- handling machine/process output
- completing production records



## REQUIRED SKILLS AND KNOWLEDGE

- monitoring operation of the machine/process
- identifying faults/deviations in product, raw materials, tooling and machine/process
- taking corrective action to correct faults/deviations in product, raw materials, tooling and machine/process

### Required knowledge

Look for evidence that confirms knowledge of:

- safety features of the machine/process being operated
- safety equipment associated with the machine/process
- the programmed operational maintenance requirements of the machine/process
- pre-start checks
- start-up/shut-down procedures
- operating procedures
- unloading procedures
- procedures for handling and storing finished work
- consequences of improper handling and storing
- recording requirements
- the emergency procedures
- product fault/deviations
- the corrective action to rectify types of product fault/deviations
- raw material faults/deviations
- the correct action to rectify raw material faults/deviations
- tooling faults/deviations
- the correct action to rectify tooling faults/ deviations
- deviations and faults in machine/process
- the correct action to rectify machine/process faults/deviations
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform advanced plastic processing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced plastic processing or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Machine and process operations
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## MEM07027B Perform advanced press operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing advanced press operations and recognising and rectifying deviations and faults in the product/output, raw material or feed stock, tooling and machine/process.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of metal working press operations including drawing, blanking, bending, coining, sizing, extruding, forming and shaping.</p> <p>This unit relates to operations where the output of the machine/ process can be varied at the discretion of the operator and where recognition/rectification skills are applied based upon product/material/process knowledge to achieve specified outcomes.</p> <p>Deviations and faults of the machine, raw material, tooling and process are recognised and rectified in accordance with standard operating procedures in order to meet the specification.</p> <p>Where interpretation of a technical drawing to Australian Standard 1100/1102 or equivalent is required, Unit MEM09002B (Interpret technical drawing) should also be selected.</p> <p>When production packaging and labelling of the finished goods or product is required, then Unit MEM11006B (Perform production packaging) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07001B	Perform operational maintenance of machines/equipment
	MEM07024B	Operate and monitor machine/process
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, job instructions and specifications are interpreted and task requirements are understood including machine/process selection and settings.
2. Observe safety precautions	2.1. Safety equipment and guards are checked for correct position and operation.
3. Conduct pre-start checks	3.1. Programmed operational maintenance is undertaken to standard operating procedures. 3.2. Pre-start checks are undertaken to standard operating procedures. 3.3. Equipment, raw material and tooling are verified to match task requirement.
4. Operate machine/process	4.1. Machine/process is started up safely and correctly. 4.2. Machine/process is operated in accordance with job instructions or standard operating procedures. 4.3. Components/feed stock is loaded and maintained consistent with production requirements. 4.4. Machine/process output is unloaded safely to standard operating procedure, as required. 4.5. Machine/process output is handled and stored in a manner not likely to cause damage, as required. 4.6. Production data is recorded to standard operating procedures.
5. Monitor machine/process	5.1. Machine/process is monitored for safe and correct operation. 5.2. Emergency procedures are understood and followed in accordance with standard operating procedures.
6. Recognise and rectify deviations and faults in product/output	6.1. Product faults/deviations such as splits, warping, deformation, dimensional errors etc. are recognised from standard operating procedures, job sheets or other documentation. 6.2. Product faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation and may be achieved by adjustment of machine/process settings within parameters.
7. Recognise and rectify deviations and faults with raw	7.1. Raw material faults/deviations such as gauge variation, hardness, colour variation etc. are recognised from standard operating procedures, job

ELEMENT	PERFORMANCE CRITERIA
material/feed stock	<p>sheets or other documentation.</p> <p>7.2.Raw material faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>
8. Recognise and rectify deviations and faults in tooling	<p>8.1.Tooling faults/deviations resulting in marks, missing detail, dimensional errors etc. are identified against specifications and reported to standard operating procedure.</p> <p>8.2.Tooling faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>
9. Recognise and rectify deviations and faults in machine/process	<p>9.1.Machine/process faults/deviations resulting in splits, distortion etc. are recognised from standard operating procedures, job sheets or other documentation.</p> <p>9.2.Machine/process faults/deviations are rectified in accordance with standard operating procedures, job sheets or other documentation.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- following job/process instructions
- checking and clarifying task-related information
- orally reporting routine information
- following oral instruction
- entering routine and familiar information onto proformas and standard workplace forms
- undertaking manual handling
- selecting appropriate processes for nominated materials
- determining required adjustments to process
- identifying and rectifying faults/deviations in product, process, tooling and



**REQUIRED SKILLS AND KNOWLEDGE**

machine

**Required knowledge**

Look for evidence that confirms knowledge of:

- characteristics and properties of materials
- job requirements
- documentation requirements
- pre-start checks
- machine/process start-up and unloading procedures
- production recording and reporting requirements
- types of product, process, tooling and machine faults/deviations and corrective actions
- procedures to be followed in emergency situations
- consequences of improper handling and storing of finished work
- consequences of selecting incorrect processes for nominated materials
- component/feed stock levels to ensure continuous process
- programmed operational maintenance requirements
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with advanced press operations

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform advanced press operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced press operations or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Machine/process</b>	Range of metal working press operations including drawing, blanking, bending, coining, sizing, extruding, forming and shaping etc.
<b>Faults/deviations</b>	Deviations and faults of the machine, raw material, process equipment and process: <ul style="list-style-type: none"> <li>• splits, warping, deformation, dimensional errors etc.</li> <li>• gauge variation, hardness, colour variation etc.</li> <li>• marks, missing detail, dimensional errors etc.</li> <li>• distortion</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07028B Operate computer controlled machines/processes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers obtaining the job instructions, conducting the pre-start checks, and operating and monitoring the computer controlled machine or process.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of NC, CNC and robot operated machines or processes in a production environment.</p> <p>Work is performed to established processes, practices, specifications and instructions as appropriate. Technical difficulties are resolved in consultation with appropriate technical advisers.</p> <p>An appropriate level of measurement skill should be selected with this unit. Where it is required to use tools, then Unit MEM18001C (Use hand tools) should also be selected.</p> <p>Where basic operation excludes setting and tool adjustment skills, then Unit MEM07024B (Operate and monitor machine/process) should be selected.</p> <p>When operational maintenance is required, unit MEM07001B (Perform operational maintenance of machines/equipment) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07024B	Operate and monitor machine/process

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain job instructions	1.1.Job sheets or equivalent instructions are understood and correctly followed.
2. Conduct pre-start checks	2.1.Pre-start checks are undertaken to standard operating procedures. 2.2.Correct safety procedures are observed and all safety equipment is checked for correct operation.
3. Operate computer	3.1.Installed computer controlled program is selected

ELEMENT	PERFORMANCE CRITERIA
controlled machine/process	<p>and verified in accordance with job instructions.</p> <p>3.2.Computer controlled machine is operated safely to product specifications using standard operating procedures.</p> <p>3.3.Machine malfunctions are identified and reported.</p> <p>3.4.Production samples are checked for compliance to specification using standard operating procedures.</p>
4. Monitor machine/process	<p>4.1.Tool wear is monitored and, where appropriate, preset tools are replaced, tool offsets are identified in computer controlled program and adjusted, or other corrective action is taken using standard operating procedures.</p> <p>4.2.Product deviation from specification is reported in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- making pre-start checks
- checking safety equipment and guards for correct operation
- following safety procedures
- selecting and verifying the correct computer controlled program
- operating the computer controlled machine
- identifying and reporting machine malfunctions
- checking parts/products for conformance to specification
- monitoring the machine or process for signs of tool wear
- taking corrective action
- reporting part or product deviations from specification

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- pre-start checks
- safety equipment and features associated with the machine/process
- safety procedures associated with the machine/process
- procedures for accessing computer controlled programs installed in the machine controller
- procedures for verifying the correct computer controlled program
- computer controlled machine operating procedures
- typical machine malfunctions
- procedures for reporting machine malfunctions
- measuring instruments/techniques
- examples of tool wear and the effect on product or part specifications
- procedures to be followed once tool wear has been detected
- replacing preset tools
- adjustments to tool offsets
- the effect of adjustments on part or product specifications
- procedures for reporting product or part deviations
- hazards and control measures associated with operating computer controlled machines/processes, including housekeeping
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate computer controlled machine/processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>EVIDENCE GUIDE</b>	
	knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating computer controlled machine/processes or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating</p>



**RANGE STATEMENT**

conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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## MEM07029B Perform routine sharpening/maintenance of production tools and cutters

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing, grinding, checking and reassembling production tooling.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the routine sharpening and maintenance of production tools/cutters in a production machining environment. Work is performed to defined procedures using fixtures to locate production tools/cutters for sharpening and maintenance.</p> <p>General off hand grinding/sharpening of tools etc. is covered by Unit MEM18002B (Use power tools/hand held operations).</p> <p>For more advanced tool and cutter grinding operations, see Unit MEM07010B (Perform tool and cutter grinding operations).</p> <p>For machine setting see Unit MEM07003B Perform machine setting (routine)</p> <p>If interpretation of technical drawings is required, Unit MEM09002B Interpret technical drawing should also be selected.</p> <p>This unit should not be selected when Unit MEM07010B (Perform tool and cutter grinding operations) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain job instructions	1.1.Job sheets or equivalent instructions are interpreted correctly and understood.
2. Observe safety precautions	2.1.Machine guards, coolant and dust extraction devices are checked for proper operation in accordance with standard operating procedures. 2.2.Correct safety procedures are observed, and

ELEMENT	PERFORMANCE CRITERIA
	protective clothing and safety glasses are worn.
3. Disassemble production tooling in preparation for sharpening	3.1. Production tooling is disassembled as required to facilitate sharpening in accordance with standard operating procedures.
4. Set up machine	4.1. Tool and cutter grinding wheels are selected, balanced and dressed in accordance with job instructions. 4.2. Fixtures for locating tools/cutters to be sharpened are mounted in accordance with job instructions.
5. Perform tool and cutter grinding	5.1. Tools and cutters to be sharpened are mounted in predetermined fixtures. 5.2. Tools and cutters are sharpened in accordance with defined procedures.
6. Check tools/cutters for conformance to specification	6.1. Tools/cutters are visually inspected and checked, and measured for conformance to specification in accordance with job instructions.
7. Assemble/reassemble production tooling	7.1. Production tooling is reassembled, and inserts are installed in accordance with job instructions. 7.2. Assembled tooling is visually inspected and checked, and measured for conformance to specification in accordance with job instructions.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting drawings and instructions
- planning a sequence of operations
- selecting and using appropriate tools
- entering routine and familiar information on to proforma and standard workplace forms

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- sequence of operations to be performed
- function of coolant and dust extraction devices
- hazards associated with tool and cutter grinding operations
- the standard grinding wheel shapes
- range of abrasive materials used in grinding wheels
- the effect of the following grinding wheel features on wheel selection and application:
  - grain size of abrasive particles
  - grade or strength of bond material
  - structure of grain spacing and dressing processes
- function and application of the full range of tool and cutter grinding accessories
- preparation requirements for tool maintenance
- requirements for checking:
  - dimensions and tolerances
  - geometry and tolerances
- surface finish
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare, grind, check and reassemble production tooling. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with perform routine sharpening/maintenance of production tools and cutters or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Production tooling</b>	Inserted boring bars, face cutters, gear cutters, grinding machines and accessories etc.
<b>Grinding wheels</b>	<ul style="list-style-type: none"> <li>• Cup, dish, diamond</li> <li>• Grain size of abrasive particles</li> <li>• Grade or strength of bond</li> <li>• Structure of grain spacing</li> <li>• Grain size of abrasive particles</li> </ul>
<b>Fixtures/equipment</b>	Dedicated holding devices e.g. clamps, vices, magnetic chucks, indicator pawls

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07030C Perform metal spinning lathe operations (basic)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic metal spinning operations (excluding CNC), using a variety of processes, spinning tools and accessories.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to manual metal spinning of sheet metals. Spinning does not include hot spinning procedures. Tool use will include either hand and/or slide tooling of varying design and materials.</p> <p>Where operational maintenance requires dismantling and replacing components, Unit MEM18055B (Dismantle, replace and assemble engineering components) should also be selected.</p> <p>If annealing is required, the appropriate unit MEM05007C (Perform manual heating and thermal cutting) should also be selected.</p> <p>Where disc blanks are cut out using a dedicated circle cutter or similar, Unit MEM07032B (Use workshop machines for basic operations) should also be selected.</p> <p>If the interpretation of technical drawings is required Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses are worn.
2. Determine job requirements	2.1. Drawings are interpreted and sequence of operation is determined. 2.2. Tools are selected to produce components to

ELEMENT	PERFORMANCE CRITERIA
	<p>specifications.</p> <p>2.3.Disc size is determined in accordance with appropriate procedures.</p>
3. Perform spinning operations	<p>3.1.Spinning speeds are calculated for various metals and metal thicknesses using appropriate mathematical techniques and reference materials.</p> <p>3.2.Correct back centre and form chucks are selected and mounted in accordance with procedures and specifications.</p> <p>3.3.Prepared disc is mounted for forming.</p> <p>3.4.A full range of spinning accessories is used including: back centre, various chucks, trimming accessories, blank centre equipment and tee-rest.</p> <p>3.5.Spinning operations are performed to specifications.</p>
4. Check components for conformance to specifications	<p>4.1.Components are checked for conformance to specifications using appropriate techniques, tools and equipment.</p>
5. Remove and store components	<p>5.1.Components are removed from the spinning lathe without marking or any deformation.</p> <p>5.2.Components are correctly stored and packaged to avoid oxidation and damage.</p>
6. Adjust and maintain spinning lathe	<p>6.1.Routine maintenance and adjustments are carried out as required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instruction
- entering routine and familiar information onto proformas and standard workplace forms
- using all basic metal spinning tools

**REQUIRED SKILLS AND KNOWLEDGE**

- minimising damage and defects
- calculating disc size and lathe speed
- undertaking manual handling related to spinning products
- using appropriate techniques, tools and equipment to measure materials and spinings

**Required knowledge**

Look for evidence that confirms knowledge of:

- sequence of spinning operation
- types of spinning tools, their functions and requirements for maintaining tools
- types of damage and defects e.g. tool marks, cracking, stress marks, thinning and incorrect finish
- spinning lathe operation
- why and how lathe speed is calculated
- reasons for types of form chuck mounting
- function and operation of accessories for basic spinning
- methods used for each process
- methods for stacking and protecting finished product
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with metal spinning lathe operations (basic)

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform basic metal spinning lathe operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>EVIDENCE GUIDE</b>	
	knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic metal spinning lathe operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating

<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Tools</b>	Spinning tools, planishing tools, backstick, trimming, beading tools etc.
<b>Metals</b>	Steel, aluminium, monel, copper, brass, zinc, pewter, silver, gold, tin, etc. of varying thicknesses
<b>Reference materials</b>	Workplace reference materials
<b>Spinning operations</b>	Spinning, beading, trimming, finishing, annealing and/or pickling
<b>Maintenance and adjustments</b>	Cleaning, lubrication etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07031C Perform metal spinning lathe operations (complex)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing complex metal spinning operations (excluding CNC), using a variety of advanced processes, spinning tools and accessories.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to complex spinning operations which require preparation of form chucks, oval spinning, thread spinning, or jobs requiring higher precision or quality using mainly brass and brass alloys. This unit also requires the use of a wide range of spinning accessories and processes, including the use of annealing.</p> <p>Where there is a requirement to join spun materials or products in addition to, or instead of, (the spinning operation of) swaging, the following units may also be required: Unit MEM05003B (Perform soft soldering), Unit MEM05006B (Perform brazing and/or silver soldering), or Unit MEM05004C (Perform routine oxy acetylene welding [fuel gas welding]), or Unit MEM05012C (Perform routine manual metal arc welding)</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM07030C	Perform metal spinning lathe operations (basic)
	MEM07032B	Use workshop machines for basic operations
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Observe safety precautions	1.1. Correct safety procedures are observed and protective clothing and safety glasses are worn.

ELEMENT	PERFORMANCE CRITERIA
2. Determine job requirements	2.1. Drawings are interpreted and sequence of operation is determined. 2.2. Tools are selected to produce components to specifications. 2.3. Disc size is determined according to relevant procedures. 2.4. Disc is cut to the correct size and tolerance.
3. Prepare form chucks for spinning	3.1. Metal turning lathe is set up for machining form chucks according to standard operating procedures and standards. 3.2. Form chuck is prepared for general spinning as per drawings and specifications. 3.3. Form chuck is prepared for seaming/swaging joints as per drawings and specifications.
4. Perform complex spinning operations	4.1. Spinning speeds are calculated for various metals and metal thicknesses using appropriate mathematical techniques and reference materials. 4.2. Correct back centre and form chucks are selected and mounted according to procedures and specifications. 4.3. Prepared disc is mounted for forming. 4.4. A full range of spinning accessories is used including: back centre, holding and sectional chucks, tee-rest, compound and additional slides, recessed and cranked followers, rollers and knurling wheels. 4.5. Spinning, beading, recessing, oval spinning, screw forming, (thread spinning) seaming, swaging, trimming finishing, annealing and pickling operations are performed to specification.
5. Check components for conformance to specifications	5.1. Components are checked for conformance to specifications using appropriate techniques, tools and equipment.
6. Remove and store components	6.1. Components are removed from the spinning lathe without marking or any deformation. 6.2. Components are correctly stored and packaged to avoid oxidation and damage.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting information on written job instructions, specifications and standard operating procedures. May include drawings
- entering information onto proformas and standard workplace forms
- following oral instruction
- using all types of metal spinning tools and accessories
- calculating disc size and lathe speed including angles and radius
- manual handling related to spinning products
- coordinating use of multi-slides and tools, feeds and speeds
- producing complex spinning shapes using a variety of processes and techniques

#### Required knowledge

Look for evidence that confirms knowledge of:

- complex spinning operations, processes and techniques
- requirements for maintaining tools and manufacturing form chucks
- types of damage and defects e.g. tool marks, cracking, stress marks, thinning and incorrect finish
- function and operation of accessories
- methods used for each process
- methods for stacking and protecting finished product
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with metal spinning lathe operations (complex)

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform complex spinning operations using a range of metal spinning lathes, accessories and measuring equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing complex metal spinning lathe operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Tools</b>	Spinning tools, planishing tools, backstick, trimming, beading tools, back centre, holding and sectional chucks, tee-rest, compound and additional slides, recessed and cranked followers, rollers and knurling wheels etc.
<b>Complex spinning operations</b>	Spinning, beading, recessing, oval spinning, screw forming, (thread spinning) seaming, swaging, trimming finishing, annealing, pickling, combined angles and multi-radii
<b>Metals</b>	Steels, aluminium, monel, copper, brass, brass alloys, zinc, pewter, silver, gold, tin, etc., of varying thicknesses

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Machine and process operations
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## MEM07032B Use workshop machines for basic operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers basic machining in a maintenance or jobbing environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to machines that include but are not limited to lathe, radial arm drill, mills etc., and covers the sharpening of tools as required.</p> <p>This unit should not be selected when Unit MEM07005C (Perform general machining) or Unit MEM07024B (Operate and monitor machine/process) have already been selected.</p> <p>For hand held/power tools use Unit MEM18002B (Use power tools/hand held operations).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify job requirements.	<p>1.1.Job requirements are interpreted from work instructions and standard operating procedures.</p> <p>1.2.Appropriate machine is selected to meet requirements.</p>
2. Set up machine	<p>2.1.Tools are selected appropriate to the work requirements.</p> <p>2.2.Cutting tools are sharpened as required.</p> <p>2.3.Tools are correctly installed using standard operating procedures.</p> <p>2.4.Guards are set and adjusted as required.</p>
3. Operate machine	<p>3.1.Material to be machined is mounted and secured using clamping device appropriate to the material and work requirements.</p> <p>3.2.Machine is operated correctly to suit work and material requirements.</p>



ELEMENT	PERFORMANCE CRITERIA
4. Check finished component	4.1.Machined component is checked against work requirements and predetermined finish.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following routine and familiar information on written job instructions, standard operating procedures and other applicable reference documents
- selecting the appropriate machine for the given task
- setting up machines and tooling within the scope of this unit, including speeds and feeds
- sharpening tools within the scope of this unit
- operating machines within the scope of this unit
- checking finished components
- checking and clarifying task-related information
- measuring components to specification within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- cutting tool sharpening methods and techniques
- tool geometry within the scope of this unit
- units of measurement, tool geometry and numerical operations within the scope of this unit
- safe operation of tool sharpening equipment
- consequences of incorrect sharpening
- machine set-up
- consequences of incorrect speeds and feeds
- procedures for operating workshop machines
- reasons for poor surface finish.
- hazards and control measures
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use workshop machines for basic operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using workshop machines for basic operations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

EVIDENCE GUIDE	
	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Machines</b>	Lathe, radial arm drill, mill etc.
<b>Cutting tools</b>	Lathe tools, milling cutters, drills etc.
<b>Materials</b>	Ferrous and non ferrous
<b>Clamping device</b>	Chucks, vices, clamps, bars and packing etc.

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07033B Operate and monitor basic boiler

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing start-up, take-over/hand-over, monitoring, shut-down and storage of a basic boiler. It includes inspection procedures as specified in manufacturers' recommendations and workplace procedures, and identification of maintenance requirements and hazard control measures.
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### Application of the Unit

<b>Application of the unit</b>	<p>All work is carried out to applicable State/Territory and National OHS legislation, standards and codes of practice.</p> <p>The boilers covered by this unit would typically have the following features: single fixed combustion air supply, non-modulating single heat source and fixed firing rate.</p> <p>The unit covers boilers used for all purposes, including the generation of steam.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select and use personnel protective equipment	1.1. Personal protective clothing and equipment is selected and used correctly and in accordance with standard workplace procedures.
2. Carry out pre-operational checks	2.1. Pre-operational checks of boiler are undertaken correctly to plant operating procedures. 2.2. Maintenance requirements and visual faults are reported according to standard workplace procedures.
3. Maintain health and safety standards in work area	3.1. Hazards and potential hazards are identified and reported according to standard workplace procedures. 3.2. Hazard prevention/control measures are selected and used as required.
4. Start boiler	4.1. Boiler is started and brought on line safely, consistent with workplace procedures and production

ELEMENT	PERFORMANCE CRITERIA
	requirements.
5. Conduct hand-over/take-over procedures	5.1. Operating status of boiler is confirmed. 5.2. Operating log is maintained and boiler status/operation is communicated according to workplace procedures.
6. Operate and monitor boiler	6.1. Boiler is operated and monitored consistent with production and safety requirements. 6.2. Boiler water quality tests are conducted to manufacturer's recommendations and workplace procedures. 6.3. Boiler water quality is adjusted as required to manufacturer's recommendations and workplace procedures. 6.4. Boiler failures/emergencies are acted on according to workplace procedures and downstream users are notified, if necessary.
7. Carry out boiler operational shut-down	7.1. Boiler is shut down consistent with workplace procedures, production and safety requirements.
8. Carry out boiler shut-down for an internal inspection	8.1. Boiler is shut down for internal inspection according to manufacturer's recommendations and workplace procedures. 8.2. Boiler is cleaned internally and externally to manufacturer's recommendations and workplace procedures.
9. Store boiler in shut-down mode	9.1. Required storage mode is identified. 9.2. Boiler is stored to manufacturer's recommendations and workplace procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and using personal protective clothing and equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- performing pre-operational checks of boiler
- identifying and reporting maintenance requirements
- identifying and reporting hazards and potential hazards in work area
- responding to boiler failures/emergencies
- applying hazard prevention/control measures
- starting boiler and bringing on line
- confirming operating status of boiler
- maintaining operating log
- communicating boiler status information
- monitoring boiler
- conducting boiler water quality tests
- adjusting boiler water quality
- shutting down boiler
- cleaning boiler internally and externally
- storing boiler

**Required knowledge**

Look for evidence that confirms knowledge of:

- personal protective clothing and equipment use and applications
- pre-operational checks such as feed water supply, boiler water level, fuel supply/heat source, boiler valves their operation and position, combustion air supply and combustion equipment
- procedures for identifying and reporting maintenance
- statutory requirements and workplace procedures for identifying and reporting hazards in the work area
- hazard prevention and control measures
- processes for starting a boiler, such as heat input, warm up of the reticulation system, steam traps and steam line purge, systems operation, reticulation line pressure, steam usage and supply
- processes for confirming operational status of boiler
- procedures for maintaining operating log
- procedures for communicating boiler status and operation
- principles of boiler operation
- boiler fittings
- preparing boiler for inspection
- procedures for monitoring a boiler, such as steam reticulation line pressure, usage, supply and quality of steam, combustion/heat source system, feed water system, fuel system combustion air supply, water level, boiler steam pressures and operation of control/safety devices etc.
- location of inspection and explosion doors
- procedures for conducting boiler water quality tests



## REQUIRED SKILLS AND KNOWLEDGE

- feed water systems and treatment
- emergency procedures such as identification of emergency, isolation of heat source, selection and application of appropriate fire fighting equipment and notification of down stream users etc.
- processes and procedures such as confirming water level, cooling down, boiler pressure/vacuum and fuel/heat source isolation etc. when operationally shutting down a boiler
- processes and procedures such as confirming boiler cooling down, vacuum/pressure, fuel/heat source isolation, removal of combustion equipment and water from boiler, isolation from any common connection and the opening of all access points required for inspection etc.
- procedures for cleaning the boiler internally and externally
- the various modes of boiler storage
- procedures for storing the boiler in open or closed condition

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate and monitor a basic boiler. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

<b>EVIDENCE GUIDE</b>	
	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating and monitoring a basic boiler or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Pre-operational checks</b>	<p>Feed water supply, boiler water level, fuel supply/heat source, boiler valves - their operation and position, combustion air supply and combustion equipment</p>
<b>Boiler</b>	<p>Single fixed combustion air supply, non-modulating single heat source and fixed firing</p>

<b>RANGE STATEMENT</b>	
	rate
<b>Hazards</b>	Chemical and thermal hazards, manual handling, guarding of machinery, illumination of work area, rubbish and combustibles, leakage of steam and fuel etc.
<b>Monitored</b>	Steam pressure, flame and combustion conditions, feed system and condensate returns, fuel system, water level, combustion management system, water management system, boiler and steam manifold fittings, soot blowers
<b>Storage mode</b>	Wet and dry storing, open or closed condition

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07034A Operate and monitor intermediate class boiler

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing start-up, take-over/hand-over, monitoring, shut-down and storage of single or multiple intermediate class boilers and associated equipment to legislative requirements, standards and codes of practice.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the start-up, take-over/hand-over and shut-down of intermediate class boilers. Boilers covered by this unit would typically have the following features: modulating combustion air supply, modulating single heat source, modulating firing rate, and or superheaters, economisers, and other associate equipment.</p> <p>The unit applies to boilers used for all purposes including steam generation and other industrial uses as required in the workplace. The boilers may be singular or in a battery of boilers.</p> <p>Work includes inspection procedures as specified in the manufacturer's recommendations and workplace procedures, identification of maintenance requirements and hazard control measures.</p> <p>All work is carried out to applicable State/Territory and National OHS legislation, standards and codes of practice, including relevant aspects of NOHSC 1006 (1995), AS 3873 (Operation and maintenance of steam plant) and AS2593 1995 (Boilers - unattended and limited attendance)</p> <p>Where basic boiler operation (e.g. single fixed combustion air supply, non-modulating single heat source and fixed firing rate) only is required, Unit MEM07033B (Operate and monitor basic boiler) should be selected.</p>
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	<b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM07033B	Operate and monitor basic boiler

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Carry out pre-operational	1.1.Pre-operational checks of boiler and associated equipment are carried out according to standard

ELEMENT	PERFORMANCE CRITERIA
checks	<p>operating procedures.</p> <p>1.2.Maintenance requirements are identified and reported in accordance with standard operating procedures.</p>
2. Maintain health and safety standards in work area	<p>2.1.Hazards and potential hazards in work area are identified and reported in accordance with statutory requirements and workplace procedures.</p> <p>2.2.Personal protective equipment and clothing is selected and used as appropriate, according to statutory requirements and workplace procedures.</p> <p>2.3.Hazard prevention/control measures are selected and used as required, in accordance with statutory requirements and workplace procedures</p>
3. Start up boiler	<p>3.1.Boiler is started and brought on line safely, consistent with workplace procedures and production requirements.</p>
4. Conduct hand-over/take-over procedures	<p>4.1.Operating status of the boiler is confirmed in accordance with manufacturer's recommendations and workplace procedures.</p> <p>4.2.Boiler status and operation is communicated according to workplace procedures and statutory requirements.</p>
5. Operate and monitor intermediate class boiler and associated equipment	<p>5.1.The boiler and associated equipment is operated and monitored consistent with production and safety requirements.</p> <p>5.2.Boiler water quality tests are conducted to manufacturer's recommendations and workplace procedures.</p> <p>5.3.Water quality is maintained according to manufacturer's recommendations and workplace procedures.</p> <p>5.4.Boiler failures and emergencies are responded to in accordance with statutory requirements, manufacturer's recommendations and workplace procedures.</p>
6. Shut down boiler and associated equipment	<p>6.1.Operational shut-downs of boiler and associated equipment are carried out in accordance with work-place procedures, production and safety requirements.</p> <p>6.2.Shut-downs of boiler and associated equipment for internal inspection are carried out in accordance with workplace procedures, production and safety</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>requirements.</p> <p>6.3.Boiler is isolated in accordance with statutory requirements, manufacturer's recommendations and workplace procedures.</p> <p>6.4.Boiler is cleaned internally and externally to manufacturer's recommendations and workplace procedures.</p>
7. Store boiler in shut-down mode	<p>7.1.Appropriate storage mode is identified</p> <p>7.2.Boiler and associated equipment is stored in shut-down mode to manufacturer's recommendations and workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- following, standard operating procedures and statutory requirements
- performing preoperational checks of boiler
- performing maintenance checks
- orally reporting routine information
- identifying hazards, hazardous situations and control measures
- using personal protective clothing and equipment
- selecting the most appropriate prevention/control measure for a given situation
- starting up boilers, including those fitted with associated equipment such as superheaters and economisers
- monitoring boilers, including checks of combustion management system and superheater and economiser operation
- checking operating status
- recording routine and familiar information in operating log and other standard workplace forms
- performing water quality tests to manufacturer's recommendations and workplace procedures
- using testing equipment
- adjusting water quality

## REQUIRED SKILLS AND KNOWLEDGE

- responding to typical emergency situations
- notifying downstream users
- performing operational and inspection shut-down, including procedures for associated equipment, such as superheaters and economisers
- isolating boiler from any common connection between the boiler and other boilers on line and all access points required for inspection

### Required knowledge

Look for evidence that confirms knowledge of:

- pre-operational checks
- procedures for identifying and reporting maintenance requirements
- statutory requirements and workplace procedures for identifying and reporting hazards in the work area
- use and application of personal protective equipment
- safe work practices and procedures
- prevention and control measures
- the processes for starting a boiler such as heat input, warm up of the reticulation system, steam traps and steam line purge, systems operation, reticulation line pressure, steam usage and supply, associated equipment such as superheaters and economisers
- the process for confirming operational status of boiler
- procedures for maintaining an operating log and communicating boiler status
- procedures for communicating boiler status and operation
- principles of intermediate boiler operation - single and battery
- boiler fittings
- preparing boiler for inspection
- feed water systems and treatment, including de-aerator function and purpose
- procedures for monitoring an intermediate class boiler, such as steam reticulation line pressure, usage, supply and quality of steam, combustion/heat source system, feed water system, fuel system, combustion air supply, water level, boiler steam pressures and operation of control/safety devices, combustion management system, associated equipment such as superheaters and economisers
- function, purpose and location of associated equipment:
  - superheater
  - economiser
  - air heater
  - feed water heater
  - attemperator
  - superheater safety valves
  - economiser relief valves
  - main steam stop valve



**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for conducting boiler water quality tests
- procedures for adjusting boiler water quality
- procedures such as identification of emergency isolation of heat source, operation of boiler, selection and application of fire fighting equipment and notification of downstream users
- operational shut-down processes and procedures such as confirming water level, cooling down, boiler pressure/vacuum and fuel/heat source isolation
- shut-down processes and procedures for internal inspection, such as confirming boiler cooling down, vacuum/pressure, fuel/heat source isolation, removal of combustion equipment and water from boiler
- isolation procedures and safety issues
- procedures for cleaning boiler internally and externally
- various modes of boiler storage, which may include integral associated equipment such as superheaters and economisers
- the reasons for selecting particular storage mode
- procedures for storing a boiler in shut-down mode

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to operate and monitor intermediate class boilers. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

**EVIDENCE GUIDE**

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating and monitoring intermediate class boilers or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Pre-operational checks**

Feed water supply, boiler water level, fuel supply/heat source, boiler valves - their operation and position, combustion air supply and combustion equipment

<b>RANGE STATEMENT</b>	
<b>Boiler</b>	Modulating combustion air supply, modulating single heat source, modulating firing rate, and or superheaters, economisers, single and battery
<b>Hazards</b>	Chemical and thermal hazards, manual handling, machine guarding, illumination of work area, rubbish and combustible materials, steam and fuel leaks etc.
<b>Associated equipment</b>	Superheater, superheater safety valves, economiser, economiser relief valves, air heater, feed water heater, attemperator, main steam stop valve
<b>Monitored</b>	Steam pressure, flame and combustion conditions, feed system and condensate returns, fuel system, water level, combustion management system, water management system, boiler and steam manifold fittings, soot blowers
<b>Storage mode</b>	Wet and dry storing, open or closed condition

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Machine and process operations
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## MEM07039A Write programs for industrial robots

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning and writing computer programs for robot operations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the writing of programs to achieve operating specifications. Programs are in accordance with manufacturers' operating procedures, manufacturer specific language and the functional parameters of the robot.</p> <p>For setting robot cells, refer to Unit MEM07040A (Set multistage integrated processes).</p> <p>For editing robot program parameters, Unit MEM10004B (Enter and change programmable controller operational parameters) should be regarded as sufficient.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10004B	Enter and change programmable controller operational parameters
	MEM12023A	Perform engineering measurements
	MEM16008A	Interact with computing technology

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify robot requirements	<p>1.1.Robot features and specifications are identified.</p> <p>1.2.Robot language is identified.</p> <p>1.3.Robot safety features are identified.</p> <p>1.4.Manufacturer's operating procedures and engineering drawings are interpreted to define robot function and tool path geometry.</p> <p>1.5.Required operations for robot and end effectors are determined in conjunction with appropriate technical experts or other technical reference sources.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Plan robot program	2.1.Programming requirements are identified. 2.2.Coordinates are calculated for tool path or robot functions. 2.3.Programming method is selected. 2.4.Program plan is developed.
3. Write basic program	3.1.Robot and computer equipment is prepared. 3.2.Program is written in required language and in accordance with standard operating procedures. 3.3.Safety features are incorporated in robot program. 3.4.Operation sheet is prepared.
4. Trial program	4.1.Program is trialled by operating robot in manual mode in conjunction with operator as appropriate. 4.2.Program performance is verified against required specifications and with appropriate technical experts or other technical reference sources. 4.3.Program is edited if necessary to adjust operation as required. 4.4.Components are checked for conformance to specifications as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, engineering drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- identifying robot features/applications/specifications
- calculating coordinates of all relevant points on the part or product to be produced
- writing programs in required programming language
- producing robot operation sheet(s)

## REQUIRED SKILLS AND KNOWLEDGE

- editing robot program
- checking parts/products for specification conformance
- undertaking program storage and filing procedures

### Required knowledge

Look for evidence that confirms knowledge of:

- classifications/applications of industrial robots, such as:
  - welding
  - thermal cutting
  - machining
  - forming and shaping
  - pick and place
  - palletising
  - machine loading/unloading
- end effectors:
  - grippers
  - tools and tool changes
- features and specifications of robots and components
- joint movements of a robot
- drive systems used to generate robot movement
- programming methods and procedures
- function of elements in controlling operation of a robot
- safety features and requirements of robots
- type(s) of robots and end effectors and their applications
- robot operations controlled by programs
- the tool path(s) when producing a part or product
- the sequence of robot operations, including movements
- the zero point of the robot
- standard codes and languages for robot programs
- procedures for completing robot operation sheets
- procedures for manual operation of the robot
- reasons for testing and proving the robot program
- procedures for editing the robot program
- the effects of editing on the operation of the robot and the part or product to be produced
- the measuring equipment/techniques used to check for conformance to specification
- hazards and control measures associated with programming robots, including housekeeping
- safe workplace practices and procedures



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to write basic robot programs. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with writing robot programming or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any

<b>EVIDENCE GUIDE</b>	
	relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Features and specifications</b>	<ul style="list-style-type: none"> <li>• Components</li> <li>• Capabilities</li> <li>• Speed</li> <li>• Reach</li> <li>• Load carrying capacity</li> <li>• Accuracy/repeatability</li> <li>• Classification</li> <li>• Polar coordinate</li> <li>• Cylindrical coordinate</li> <li>• Cartesian coordinate</li> <li>• Jointed elbow</li> <li>• SCARA</li> <li>• Movements</li> <li>• Base</li> <li>• Shoulder</li> <li>• Elbow</li> <li>• Pitch</li> <li>• Roll</li> <li>• Yaw</li> <li>• Applications</li> <li>• Required operating conditions</li> <li>• Limitations</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Justification</li> <li>• Safety features</li> </ul>
<b>Language</b>	Language appropriate to robot type
<b>Safety features</b>	<ul style="list-style-type: none"> <li>• AS2939 - 1987 - Industrial Robot Safety - Safe Design and Usage</li> <li>• Physical design</li> <li>• Enclosures</li> <li>• Layout</li> <li>• Programming</li> <li>• Sensing</li> <li>• Personnel</li> </ul>
<b>Method</b>	<ul style="list-style-type: none"> <li>• Manual</li> <li>• Walkthrough</li> <li>• Leadthrough</li> <li>• Offline</li> <li>• Optical/vision or sensor systems</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Machine and process operations
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## MEM07040A Set multistage integrated processes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting, according to defined procedures, a wide range of processes that incorporate checking of sensors, process links, displays, monitors, feedback loops etc.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to setting a wide range of continuous process lines and processes, where operations are performed by machines and equipment that are sequentially linked. This may include process lines and robot cells.</p> <p>This may also include mechanical assembly operations, electrical/electronic assembly operations and processes such as welding, testing, insertion, filling, printing, hot stamping etc.</p> <p>Where setting or adjustment of numerical control (NC) /computer numerical control (CNC) or programmable logic control (PLC) is required, then appropriate units should be selected.</p> <p>If robot operation, editing and/or programming skills are required, appropriate units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM14005A	Plan a complete activity
	MEM16006A	Organise and communicate information
	MEM16008A	Interact with computing technology
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Determine process	1.1.Job sheets/instructions are interpreted and understood.
2. Select and use a range of hand tools and equipment	2.1.Hand tools and equipment are used in a safe manner in accordance with standard operating procedures.
3. Set process line	3.1.Process line is set up to specifications in accordance with standard operating procedures. 3.2.All sensors, process links, displays, monitors, feedback loops etc. are set up to specifications using standard operating procedures. 3.3.All safety apparatus is in place and checked for correct operation. 3.4.Process line is run to meet predetermined production and quality requirements. 3.5.Process line is adjusted to meet specifications and operational requirements. 3.6.Operator(s) are instructed as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings related to setting multistage continuous process lines
- using specialist tools
- coordinating the running of multi-process lines
- entering routine and familiar information onto proformas and standard workplace forms
- verbally conveying information/instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- communication strategies for giving clear instruction

## REQUIRED SKILLS AND KNOWLEDGE

- specifications and sequencing that apply to given process lines
- interpretation of feedback from machine process
- specifications applicable to the sensors, process links, displays, monitors, feedback loops etc. incorporated in the process line
- correct operation and specification for all safety apparatus incorporated in the process line
- product specifications and quality and production requirements
- the effect of process line adjustments on product and operational specifications
- operator procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with setting of multistage continuous process lines

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to set, in accordance with determined procedures, a wide range of continuous process lines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working



**EVIDENCE GUIDE**

	<p>alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting multistage continuous process lines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Job sheets/instructions**

Written and verbal job instructions, specifications and standard operating procedures. May include drawings related to setting multistage continuous process lines

**Safety apparatus**

Guards, personal protective equipment,

**RANGE STATEMENT**

	emergency switches
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Machine and process operations
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# MEM07041A Perform production machining

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers production machining using a range of engineering machinery, such as lathes, milling machines and grinders. It includes determining the job requirements and sequence of operations, selecting and mounting tools, performing the machining, measuring the components, and adjusting and maintaining a range of standard machine tools.

## Application of the Unit

The unit of competency applies to the use of workshop machines in a volume production environment to shape metal, including lathes, mills, planers, shapers, radial arm drills, slotters and grinders.

This unit will typically apply to senior operators undertaking volume production who have responsibility for machine set up to defined parameters, selection of materials and lubricants, establishment of datum points and basic marking out, as well as setting speeds, feeds and other machining parameters.

This unit has application in the MEM20205 Certificate II in Engineering - Production Technology and MEM30105 Certificate III in Engineering - Production Systems and other qualifications requiring production machining skills.

Where machining is undertaken without the need for any set up, including mounting of tools, setting of speeds, feeds and other operational parameters, then either MEM07024B Operate and monitor machine/process or MEM07025B Perform advanced machine/process operation should be selected. Drilling operations in this unit exclude those covered by MEM18002B Use power tools/hand held operations. For set up and operation of electro-discharge (EDM) machines, refer to MEM07014B Perform electro-discharge (EDM) machining operations.

**Band:** A

**Unit weight:** 8

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

- MEM09002B Interpret technical drawing
- MEM12023A Perform engineering measurements
- MEM18001C Use hand tools

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Determine job requirements             | 1.1 | Review drawings or charts, instructions and specifications for details of item to be produced |
|   |  | 1.2 | Confirm number of items to be produced  |
|   |  |     |   |
| 2 | Follow required sequence of operations | 2.1 | Identify appropriate standard operating procedure (SOP) for machining operation               |
|   |  | 2.2 | Plan operation for required run rate, efficiency and minimisation of waste                    |
|   |  | 2.3 | Select correct material for operation from pre-determined stock range                         |
|   |  | 2.4 | Establish starting point on stock for operation   |
|   |  | 2.5 | Maintain process and quality logs   |

- |   |   |     |   |
|---|---|-----|---|
| 3 | Select and mount tools                  | 3.1 | Select appropriate tooling from pre-selected range  |
|   |   | 3.2 | Select appropriate stock and grind to required tool shape using pre-set jigs and fixtures to achieve pre-determined angles and clearances |
|   |   | 3.3 | Monitor tooling and sharpen tools and drills, as required, to pre-determined specifications   |
| 4 | Perform production machining operations | 4.1 | Use basic marking out techniques to pre-determined specifications on stock or components  |
|   |   | 4.2 | Set machining parameters for job requirements   |
|   |   | 4.3 | Monitor tool or cutter performance life   |
|   |   | 4.4 | Clamp or hold work without damage to product and ensuring all safety requirements are met   |
|   |   | 4.5 | Perform machining utilising all guards, safety procedures and personal protective clothing and equipment                                  |
| 5 | Perform production grinding operations  | 5.1 | Select appropriate grinding wheel for required operation from pre-selected options  |
|   |   | 5.2 | Mount and tighten grinding wheels to required sequence and specification  |
|   |   | 5.3 | Position dressing tool correctly  |
|   |   | 5.4 | Dress and true grinding wheel using given range of dressing tools   |
|   |   | 5.5 | Check grinding wheel for balance and safety   |
|   |   | 5.6 | Adjust coolant flow and position  |
|   |   | 5.7 | Undertake grinding operation utilising all guards, safety procedures and personal protective clothing and equipment                       |
|   |   | 5.8 | Monitor grinding wheel performance and life according to SOP  |

6	Measure components	6.1	Select instruments or gauges appropriate to the measurement requirements
		6.2	Check machined or ground items for compliance with specifications
		6.3	Identify out of specification items and check if settings or tooling require adjustment
7	Adjust and maintain machine	7.1	Carry out routine maintenance and adjustments, as required, which may include slide and collar adjustment, cleaning and lubrication
		7.2	Report and log malfunctions according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills include:

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures which may include drawings
- following oral instruction
- planning and sequencing operations
- preparing operational work plan
- drill sharpening
- sharpening and shaping cutting tools
- identifying worn or damaged cutting tools
- correct mounting and positioning of cutting tools
- basic marking out of materials
- setting machining parameters to achieve the job requirements and maximise tool life
- using appropriate and sufficient clamping/mounting of the work piece
- using coolant/lubricant correctly
- checking for conformance to specifications
- measuring to specified tolerances and dimensions

### Required knowledge includes:

- reasons for selecting the chosen sequence of operations

- methods of work holding
- basic marking out techniques, including datum points/lines
- benefits of using correctly sharpened cutting tools
- machine operation
- selection of feeds and speeds to SOPs
- correct methods of mounting selected cutting tools to SOPs
- safety issues with regard to correct clamping, guards and shields
- tolerances and limits of size
- situations indicating the need for machine adjustment, lubrication and cleaning
- techniques, tools and equipment to measure materials and machined components
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with general machining
- types and features of industrial grinding wheels, including:
  - international grinding wheel identification system
  - grinding wheel make-up, including bonds and grits
- purpose and procedure for grinding wheel truing
- indicators of a need for grinding wheel dressing, including:
  - wheel glazing
  - wheel loading
  - wheel dresses
  - wheel drilling
- difference between centred and centreless grinding
- indicators of need for dressing, including:
  - loading
  - dulling
  - glazing
  - burn/thermal damage
  - surface finish
- grinding wheel storage and handling
- wheel safety checking, including checks for:
  - cracks
  - defects (e.g. holes, moisture and deterioration)
- grinding wheel blotters
- typical range of industrial drills and classification
- drilling machines
- drill sharpening procedures
- drill clamping arrangements
- common reasons for machining failure, including:
  - incorrect speed
  - faulty positioning of work

- incorrect feed
- rotation
- incorrect coolant selection and positioning

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform production machining, including responsibility for selecting and mounting tooling, and setting of machine within defined parameters.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence include:</p> <ul style="list-style-type: none"> <li>• correct job planning, including identifying job requirements from drawings, instructions or specifications, and sequence of operations</li> <li>• selecting appropriate tooling, measuring equipment, material and accessories from a predetermined range</li> <li>• selecting and mounting required tooling or grinding wheels</li> <li>• setting machining parameters</li> <li>• checking machined components for conformance to specifications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>



<b>Method of assessment</b>	<p>Assessment should occur on a variety of machines and across a range of machining tasks. Assessment must include consideration of performance evidence as demonstrated in a volume production environment. The candidate must be able to demonstrate performance across a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing general machining or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Production machining</b>	Production machining refers to use of workshop machines for volume production of parts or components made of metal or other machinable materials where the machine operator has responsibility for the setting up of the machine, including tooling, grinding wheels, and other accessories within defined parameters. It does not include one-off jobbing on workshop machines or complex calculations. Tolerances and tool paths will normally have been set in advance
<b>Operations</b>	Operations may include: <ul style="list-style-type: none"><li>• parallel cutting</li><li>• slotting</li><li>• drilling</li><li>• knurling</li><li>• cutting flats</li><li>• centred and centreless grinding operations</li></ul>
<b>Materials</b>	Materials may include ferrous and non-ferrous metals as well as other machinable materials
<b>Tooling</b>	Tooling may include: <ul style="list-style-type: none"><li>• carbide, ceramic and high speed steel machine tooling cutting tool accessories and holding devices</li></ul>
<b>Measuring devices</b>	Measuring devices may be: <ul style="list-style-type: none"><li>• rulers</li><li>• gauges</li><li>• verniers and micrometers (digital or analog)</li></ul>

<b>Marking out techniques</b>	Marking out techniques may include: <ul style="list-style-type: none"><li>• basic marking out techniques using calipers, steel rules, dividers and scribes</li></ul>
<b>Machining parameters</b>	Machining parameters may include: <ul style="list-style-type: none"><li>• speeds</li><li>• feeds</li><li>• stops</li><li>• coolant and cutting lubricants</li></ul>
<b>Machines</b>	Machines may include: <ul style="list-style-type: none"><li>• lathes</li><li>• mills</li><li>• planers</li><li>• shapers</li><li>• radial and pedestal drills</li><li>• slotters</li><li>• grinders</li></ul>
<b>Maintenance and adjustments</b>	Maintenance and adjustments may include: <ul style="list-style-type: none"><li>• slide and collar adjustment</li><li>• cleaning and lubrication</li></ul>
<b>Types and features of industrial grinding wheels</b>	Types and features of industrial grinding wheels refers to: <ul style="list-style-type: none"><li>• wheel make-up</li><li>• wheel hubs</li><li>• wheel classification</li><li>• types of grits and bonds</li></ul>
<b>Dressing tools</b>	Dressing tools for this unit are limited to: <ul style="list-style-type: none"><li>• industrial diamond</li><li>• dressing wheels</li><li>• dressing sticks</li></ul>

<b>Balancing of grinding wheels</b>	Balancing for this unit is limited to checks and identification for balance. Correction of out of balance wheels is not covered by this unit

## Unit Sector(s)

### Competency field

### Unit sector

## Custom Content Section

Not applicable.

# **MEM07042A Undertake corrections and basic maintenance to aluminium extrusion dies and die support systems**

## **Modification History**

New unit - Release 1

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to correct aluminium extrusion dies and die support systems after faulty extrusions have been examined and causes of faults identified.

## **Application of the Unit**

This unit applies to die correctors in an aluminium extrusion workplace who are making corrections to aluminium extrusion dies and their die support systems as well as undertaking basic maintenance of dies. The unit applies to both solid and hollow dies. The corrections may be made using hand tools, handheld power tools, or workshop machines.

The unit does not cover manufacture of dies or major repair or remanufacture of dies. This unit presumes that the cause/s of faulty extrusions has already been identified.

The units MEM11010B Operate mobile load shifting equipment and MEM11011B Undertake manual handling should be selected where the die corrector is required to remove and replace dies in extruders.

Band: A

Unit Weight: 4

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM07001B Perform operational maintenance of machines/equipment

MEM07003B Perform machine setting (routine)

MEM07004B Perform machine setting (complex)

MEM07024B	Operate and monitor machine/process
MEM07025B	Perform advanced machine/process operation
MEM07032B	Use workshop machines for basic operations
MEM07043A	Identify causes of faulty aluminium extrusions
MEM07044A	Test a new aluminium extrusion die
MEM09002B	Interpret technical drawing
MEM12023A	Perform engineering measurements
MEM18001C	Use hand tools
MEM18002B	Use power tools/hand held operations
MEM18003C	Use tools for precision work
MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

1	Prepare for die correction	1.1	Identify work health and safety (WHS), regulatory requirements, and risk management procedures relevant to die access and handling, extruder operation and die correcting procedures
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- |   |                     |     |  |
|---|---------------------|-----|--|
|   |                     | 1.2 | Identify extrusion specifications, extruder operating procedures and other information relevant to die correction task |
|   |                     | 1.3 | Where required, consult with die designer on intended correction   |
| 2 | Correct solid dies  | 2.1 | Calculate intended change in extrusion flow or speed   |
|   |                     | 2.2 | Determine bearing choke angles or length of bearing shortening as appropriate for required correction                  |
|   |                     | 2.3 | Speed up flow, where required, through appropriate shortening of bearing   |
|   |                     | 2.4 | Slow down flow, where required, through appropriate choking of bearing   |
|   |                     | 2.5 | Relieve clearances   |
|   |                     | 2.6 | Supervise or run trial extrusions to test corrections  |
| 3 | Correct hollow dies | 3.1 | Assess if shortening or choking of mandrel bearings is required and select bearings to be corrected                    |
|   |                     | 3.2 | Determine choke angles and length of shortening as appropriate for required corrections                                |
|   |                     | 3.3 | Undercut mandrel to widen chambers, where required   |
|   |                     | 3.4 | Increase depth of chamber back into bridge, where required   |
|   |                     | 3.5 | Adjust mandrel stems, where required   |
|   |                     | 3.6 | Adjust weld bridges, as required   |
|   |                     | 3.7 | Speed up flow, where required, through appropriate shortening of bearing   |
|   |                     | 3.8 | Slow down flow, where required, through appropriate choking of bearing   |
| 4 | Undertake basic     | 4.1 | Monitor case and assess when re-nitriding is required  |

maintenance of dies	4.2	Prepare die for re-nitriding
	4.3	Clean and polish dies when required
	4.4	Repair fine bearing damage
	4.5	Maintain bearing angle and flatness during polishing and repairs
	4.6	Monitor fittings and devices for lifting die and die support components and arrange replacement or repair as necessary
5 Adjust die support system and components	5.1	Ensure toolstack components are flat and square with die
	5.2	Check for and replace any coined bolsters
	5.3	Check die slide alignment is within tolerance and re-align if necessary
	5.4	Report persistent die support related faults after adjustment and recommend redesign or stiffening as appropriate
6 Maintain die records	6.1	Record details of all die corrections, including trial extrusions
	6.2	Recommend any simple die design changes that increase productivity and recovery

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- shortening of bearings through milling, grinding, hand or machine polishing as appropriate to speed up flow or increase feed
- techniques to choke bearings to achieve slowing of flow, including:



- opening of angle of bearing on inner web
- hand filing
- machining and dressing of bearings to remove roughness and rags
- peening of bearings
- surface grinding of die face
- chiselling ends of blunt bridges in hollow dies
- undercutting of mandrels to relieve blockages
- increasing pocket clearances
- performing precision measurement
- adjusting bolster and die support, including:
  - selection of different size backers
  - polishing of surfaces to overcome dishing
- identifying simple die design changes (e.g. layout, orientation, number of holes, and so on) to increase productivity and recovery
- recording corrections on die history cards and providing feedback to die designers

## Required knowledge

Required knowledge includes:

- die technology:
  - construction:
    - solid dies
    - hollow dies
    - die support components
    - composition and characteristics of various die steels
  - die manufacturing process
  - nitriding process and purpose
  - extrusion design process and behaviour of typical shapes during extrusion
  - bearings:
    - shape and definition
    - bearing deflections
    - bearing wash
    - bearing choke where entrance to die aperture is wider than the exit angle
    - negative bearing (entrance is narrower than the exit angle) increases speed of flow
- die support technology and common faults:
  - bolsters:
    - matching of dies to bolsters
    - typical faults in extrusions related to poor bolster selection or fit
  - backers:
    - softening

- dishing
- feeder plates:
  - tolerances too close can cause heat related surface defects on extrusions
  - tolerances not matched to bearings in die can cause shape loss
- extrusion process:
  - shape behaviour of typical extrusion products
  - channel shapes and tongue movement faults and typical distortions and corrections
  - runout length variations and possible causes:
    - recycled and unevenly cooled billets
    - out of alignment die slides
    - bearings worn or polished unevenly
  - operator variables:
    - incorrect heat settings
    - incorrect selection of bolster for die
    - poor breakthrough management
  - principles of flow:
    - variation of flow speed through local details and thicknesses
    - variation across container diameter
    - variation due to length of bearing
    - speed of metal through die along with temperature determines how metal flow fills die
  - source and purpose of heating of:
    - billet
    - die
    - extrusion and extrusion created heat
  - surface defects and their causes:
    - die lines caused by roughness at surface edges, damaged bearing edges, bearing wash or flaking of nitriding
    - pick up (surface tearing)
    - streaking
    - blisters
    - inclusions in billets
    - nitriding flaking off die face
  - effects of incorrect heat:
    - collapsing of thin walled sections due to over heating
    - blocking of the die
  - surface breakdown and faults:
    - roughness
    - streaking
    - tearing

- dangers of welding extrusion dies
- die efficiency considerations:
  - monitor die performance over time using examine die and extrusion records
  - balance die correction against tonnage, speed and recovery rates
  - recommend new die or major re-work by die manufacturer where required

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to take a systematic approach to correcting solid and hollow dies and their die support systems, including conducting trial extrusions to verify corrections. Proper use of hand and power tools and workshop machines is required in undertaking corrections.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- comply with WHS, regulatory requirements and risk management associated with extruder operation and die handling
- relate intended changes to bearings, apertures, other die components, and toolstack components to particular extrusion faults
- adjust metal flow using workshop machines, hand tools and handheld power tools to correct bearings
- maintain bearings and other die components to specification
- identify situations where die or other components must be either scrapped or returned to die manufacturer
- supervise or conduct trial extrusions to verify corrections
- report and document results of corrections.
- This unit must be assessed on the job with access to the extruder for which the die has been designed and relevant die and extrusion records. Access to hand and machine tools, including a milling machine, surface grinder and relevant

### Context of and specific resources for assessment

hand and power tools, are also required.

- The competencies covered by this unit would usually be demonstrated by an individual working in a team environment that includes extruder operators, die designers and die makers. The assessment environment should not disadvantage the candidate.
- This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with die correcting.

### **Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.
- Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessment may be in conjunction with assessment of other units of competency where required.

### **Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## **Range Statement**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may

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be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Die support</b>	Die support is the specified toolstack dimensions that will support dies, according to the force the extruder can exert.
<b>Container</b>	The container is the part of the extruder that holds the billet and billet support components.
<b>Support tooling</b>	Support tooling is the name given to the various pieces of tooling (e.g. bolsters that provide stiffness to the die during extrusion).
<b>Die holder</b>	Die holders accommodate the diesets (feeder plate, die plate and backer). Die holders are the first components in toolstacks.
<b>Bolster</b>	Bolsters are deep discs of steel that provide stiffness in the toolstack to allow the die to remain flat and thus do its work properly. The term bolster includes any inserts designed to cut the cost of support tooling.
<b>Die slide</b>	The die slide is the part of the extruder that accommodates the dies and other tooling that makes up the toolstack.
<b>Toolstack</b>	The toolstack is the assembly of die, feeder plate and backer, holder and support tooling that fits into the die slide.
<b>Die</b>	The die is the part of the tooling that creates the extrusion shape as the metal is pressed through it.
<b>Bearing</b>	The die contains bearings of various lengths. Bearings are lands that act as frictional controls on metal flow. The bearing is an outline of the extrusion shape cut through the die to the highest precision possible.
<b>Feeder plate</b>	The feeder plate precedes the die and provides an additional degree of flow control. It is also described as a control plate. It is bolted to the die and backer, forming the dieset.
<b>Backer</b>	The die must be given support against the force needed to make metal flow. The first item of this support is the backer. Backer profiles are usually slightly larger than die apertures (precision cut) and

	are not high precision items.
<b>Platen plate</b>	The platen plate or pressure ring is set into the front wall of the press as a replaceable feature. Platen plates take up the forces applied to the toolstack and transmit them to the extruder structure.
<b>Primary and secondary bolsters</b>	<p>Some larger press operate with a combination of single, one piece bolsters for special shapes and a split system of primary and secondary bolsters.</p> <p>The primary bolster is usually deeper than the secondary and provides the main support. It is cut closer to the die aperture than the secondary bolster which closely follows the primary aperture so as to back it up.</p> <p>Secondary bolsters are likely to be shared by several primary bolsters.</p>

## Unit Sector(s)

**Competency field** Machine and process operations

**Unit sector**

## Custom Content Section

Not applicable.

## **MEM07043A Identify causes of faulty aluminium extrusions**

### **Modification History**

New unit - Release 1

### **Unit Descriptor**

This unit of competency covers the skills and knowledge needed to systematically examine aluminium extrusions for faults and to trace the reasons for the faults. This unit includes determining the most appropriate corrective action for the fault and, where appropriate, providing recommendations to extruder operators, die designers and die manufacturers.

### **Application of the Unit**

This unit applies to die correctors working in an aluminium extrusion workplace who are required to investigate product fault reports, including determining the root cause of the fault, and recommending the most appropriate action. The unit applies to extrusions produced on solid and hollow dies and to faults that are both die and non-die related.

Band: A

Unit Weight: 6

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

- MEM09002B Interpret technical drawing
- MEM12023A Perform engineering measurements
- MEM12024A Perform computations
- MEM15002A Apply quality systems
- MEM15024A Apply quality procedures
- MEM16006A Organise and communicate information
- MEM18001C Use hand tools

MEM18002B Use power tools/hand held operations

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Collect information on faulty extrusion	1.1	Liaise with extruder operator on die service or fault correction requests
		1.2	Access and examine die following all relevant work health and safety (WHS) procedures
		1.3	Examine extruder records and identify any previous die corrections
		1.4	Consult with die designer on faults, where required
		1.5	Examine extruder maintenance records and liaise with maintenance department, where required
2	Interpret die drawing and specifications	2.1	Identify layout and pre-forming of die apertures
		2.2	Identify bearing and pocket design/specification
		2.3	Identify measurements and tolerances for bearings, die components and die support system
		2.4	Identify bolster and spacer specification for die



- 2.6 Identify press specifications
  - 2.7 Identify speed estimate for die
  - 2.8 Identify ports and bridges for hollow dies
- 3 Examine faulty extrusions
  - 3.1 Check extrusions for shape distortion
  - 3.2 Check extrusion measurements are to specification
  - 3.3 Inspect surface finish of extrusions for defects
  - 3.4 Identify whether faults apply from the start to the end of extrusion runouts
  - 3.5 Make a preliminary assessment as to whether faults are related to die or die support system or other factors
- 4 Check for faults not related to die or die support system
  - 4.1 Examine die and billet heating and temperature records and confirm heating and temperature was to specification
  - 4.2 Confirm extruder was run at correct speed and other settings were to specification
  - 4.3 Examine billet history and determine if billet was recycled or faulty
  - 4.4 Confirm with maintenance department that extruder is free of mechanical, electrical, control or structural faults
- 5 Identify die and die support related faults
  - 5.1 Safely access die and die support system
  - 5.2 Inspect die for overall wear, dishing, damage and other defects
  - 5.3 Inspect bearings for shortening, surface defects, loss of specified angle and clearances
  - 5.4 Determine if die can be corrected, scrapped or returned to manufacturer
  - 5.5 Inspect die support system and components for defects and die slide misalignment

- |   |   |     |   |
|---|---|-----|---|
| 6 | Record cause of fault and communicate as required | 6.1 | Prepare recommendations for die correction and obtain any required approvals                              |
|   |   | 6.2 | Prepare recommendations for any changes to process or temperature settings and distribute, as appropriate |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting die maintenance requests for information on likely fault causes
- liaising with extruder operators, die designers and die makers, and maintenance department
- interpreting die drawings
- interpreting production records and die maintenance records
- evaluating solid die extrusion faults, including:
  - loss of shape
  - incorrect extrusion length, width or thickness
  - surface faults
- evaluating hollow die extrusion faults, including:
  - loss of shape
  - incorrect extrusion length, width or thickness
  - surface defects
  - unbalanced flow through ports
  - speed differences through die
  - collapse of extrusion or extrusion features
- evaluation of die support system for:
  - slide alignment
  - coining (impression) of bolster
  - faults and incorrect tolerances and alignment of backers, feeder plates and bolsters

### Required knowledge

Required knowledge includes:

- aluminium extrusion process, including:

- die heating
- billet heating
- loading of dies and billets
- breakthrough control
- flow speed
- rolling
- quenching
- stretching
- aluminium extrusion alloys and their extrusion performance
- extruder components and controls
- requirements of AS/NZS 1866:1997 Aluminium and aluminium alloys – Extruded rod, bar, solid and hollow shapes for extruded products
- causes of die deformation, including:
  - damaged or die
  - poor or incorrect die support due to:
    - poor manufacture
    - wear
    - incorrect component placement/selection
- die and die support design and die manufacturing related faults, such as
  - tolerances and clearances too tight and beyond range of realistic correction by die corrector
  - tolerances and clearances too great causing components to move out of position during extrusion leading to flow blockage
- reasons for die blockage, including:
  - die damage
  - over polishing or incorrect die polishing
  - tongue bending
  - bearing clearances too tight
  - overheating of billet
- indicators of die support faults, including:
  - deflecting mandrels
  - die dishing
  - die movement during extrusion
  - check for metal extruding inwards or outwards
- effects of nitriding and re-nitriding on die performance
- billet composition and billet heating procedures
- changes in billet composition caused by reheating
- process related faults:
  - incorrect temperature settings for pre-heating of billet
  - bad breakthrough control by operator (setting too fast or too high a pressure):

- poor extruder settings
- speed through die too fast/slow
- fouling of section on relief
- unsuitable support of extrusion after exiting die
- poor/incorrect quenching
- faults not subject to action by die corrector
- poor quality billet
- mechanical/electrical fault with extruder
- types of extrusion faults and their relationship to die correction techniques and die correction limitations, including:
  - shape distortion:
    - during extrusion
    - on exit from die
    - loss during quenching
  - length overruns
  - section collapse
  - surface faults, such as:
    - breakdown
    - pickup
    - tearing
    - streaking
    - die lines

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to take a systematic approach to the identification of the cause of faults in aluminium extrusions and to determine the appropriate action to remedy the fault.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- comply with WHS, regulatory requirements and risk management procedures
- correctly identify bearings, apertures, components, and critical measurements and tolerances on die

drawing

- liaise with extruder operators, die designers and die makers to obtain information to assist in the identification of causes of faults
- identify root cause of faults in both hollow and solid die extrusions
- identify die, die support, process and temperature-related shape and surface faults
- identify appropriate action to take to remedy extrusion faults
- access, analyse and add to die history records.
- This unit may be assessed on the job or a combination of both on and off the job. Access to the extruder and die producing the faulty extrusions and to die and extrusion records must be possible.
- Assessment must cover extrusions produced by both solid and hollow dies and across a range of extrusion shapes and faults.
- The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
- This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with die correcting.

### **Context of and specific resources for assessment**

### **Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.
- Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.

- Assessment may be in conjunction with assessment of other units of competency where required.

### Guidance information for assessment

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Die support</b>	Die support is the specified toolstack dimensions that will support dies, according to the force the extruder can exert.
<b>Container</b>	The container is the part of the extruder that holds the billet and billet support components.
<b>Support tooling</b>	Support tooling is the name given to the various pieces of tooling (e.g. bolsters that provide stiffness to the die during extrusion).
<b>Die holder</b>	Die holders accommodate the diesets (feeder plate, die plate and backer). Die holders are the first components in toolstacks.
<b>Bolster</b>	Bolsters are deep discs of steel that provide stiffness in the toolstack to allow the die to remain flat and thus do its work properly. The term bolster includes any inserts designed to cut the cost of support tooling.
<b>Die slide</b>	The die slide is the part of the extruder that accommodates the dies and other tooling that makes up the toolstack.
<b>Toolstack</b>	The toolstack is the assembly of die, feeder plate and backer, holder and support tooling that fits into the die slide.

<b>Die</b>	The die is the part of the tooling that creates the extrusion shape as the metal is forced through it.
<b>Bearing</b>	The die contains bearings of various lengths. Bearings are lands that act as frictional controls on metal flow. The bearing is an outline of the extrusion shape cut through the die to the highest precision possible.
<b>Feeder plate</b>	The feeder plate precedes the die and provides an additional degree of flow control. It is also described as a control plate. It is bolted to the die and backer, forming the dieset.
<b>Faults</b>	<p>Faults expected to be considered by a die corrector include faults in:</p> <ul style="list-style-type: none"> <li>• dies</li> <li>• die support systems</li> <li>• billet and die heating</li> <li>• billet composition</li> <li>• extruder settings</li> <li>• extruder operation</li> </ul>
<b>Backer</b>	The die must be given support against the force needed to make metal flow. The first item of support is the backer. Backer profiles are usually slightly larger than die apertures (precision cut) and are not high precision items.
<b>Platen plate</b>	The platen plate or pressure ring is set into the front wall of the press as a replaceable feature. Platen plates take up the forces applied to the toolstack and transmit them to the extruder structure.
<b>Primary and secondary bolsters</b>	<ul style="list-style-type: none"> <li>• Some larger press operate with a combination of single, one piece bolsters for special shapes and a split system of primary and secondary bolsters.</li> <li>• The primary bolster is usually deeper than the secondary and provides the main support. It is cut closer to the die aperture than the secondary bolster which closely follows the primary aperture so as to back it up.</li> <li>• Secondary bolsters are likely to be shared by several primary bolsters</li> </ul>

## **Unit Sector(s)**

**Competency field** Machine and process operations

**Unit sector**

## **Custom Content Section**

Not applicable.



## **MEM07044A Test a new aluminium extrusion die**

### **Modification History**

New unit - Release 1

### **Unit Descriptor**

This unit of competency covers the skills needed by die correctors working in an aluminium extrusion workplace who are required to undertake the initial testing of a new extrusion die. The unit includes liaison with die designers and makers on the performance of the new die and making corrections to the die to ensure optimal performance.

### **Application of the Unit**

This unit applies to die correctors who have received a new die for installation and testing in an aluminium extrusion machine. This unit applies to testing of the new die's performance against design and product specifications. The unit requires testing of both solid and hollow dies, and includes evaluation of extruded product for any faults, determining the root cause of faults, and adjusting the die support system or correcting the new die as required.

Band: A

Unit Weight: 4

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM07043A Identify causes of faulty aluminium extrusions

MEM09002B Interpret technical drawing

MEM12023A Perform engineering measurements

MEM12024A Perform computations

MEM18001C Use hand tools

MEM18002B Use power tools/hand held operations

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Interpret die drawing and die specifications relevant to die trial | 1.1 | Identify work health and safety (WHS), regulatory requirements and risk management requirements associated with extruder operation and die handling |
|   |  | 1.2 | Identify layout and pre-forming of die apertures  |
|   |  | 1.2 | Identify bearing and pocket design/specification  |
|   |  | 1.3 | Identify measurements and tolerances for bearings, die components and die support system  |
|   |  | 1.4 | Identify bolster and spacer specification for die   |
|   |  | 1.5 | Identify press specifications   |
|   |  | 1.6 | Identify speed estimate for die   |
|   |  | 1.7 | Identify ports and bridges for hollow dies  |
| 2 | Liaise with die designer   | 2.1 | Clarify die drawing and die specifications with die designer where design information is not clear  |
|   |  | 2.2 | Determine if die requires finishing off and clarify final design measurements, tolerances and speed specifications                                  |
|   |  | 2.3 | Obtain any special instructions from die designer for conduct of test extrusions  |

- |   |  |     |   |
|---|--|-----|---|
| 3 | Finish off die, if required                                  | 3.1 | Finish lands and bearings to specified tolerances   |
|   |  | 3.2 | Finish ports, bridges and mandrels of hollow dies, if required  |
|   |  | 3.3 | Undertake any final polishing   |
|   |  | 3.4 | Confirm all measurements are to design specification after finishing off  |
| 4 | Analyse trial extrusions                                     | 4.1 | Check extruder and surrounds for compliance with operation safety requirements  |
|   |  | 4.2 | Operate or supervise operation of extrusion press to produce trial extrusions   |
|   |  | 4.3 | Check hot extrusions for shape distortion   |
|   |  | 4.4 | Check thickness of extrusions are to specification  |
|   |  | 4.5 | Check surface finish of extrusions  |
|   |  | 4.6 | Identify whether faults apply from the start to the end of the runout of the extrusions   |
|   |  | 4.7 | Conduct additional trial extrusions to confirm extrusion faults occur consistently  |
|   |  | 4.8 | Record extruder settings for each trial extrusion   |
| 5 | Identify appropriate remedy for out of specification results | 5.1 | Examine faulty extrusions and determine if fault relates to die design, incorrect process or temperature settings, or faulty die support system |
|   |  | 5.2 | Determine fault is die related and able to be eliminated through correction of die  |
|   |  | 5.3 | Determine if fault can be corrected through adjustments to die supports   |
|   |  | 5.4 | Determine if fault can be eliminated through adjusted process control or billet heating   |
|   |  | 5.5 | Recommend either return of die for re-design or manufacture of a new die where faults are unable to be  |

corrected

- |   |                              |     |   |
|---|------------------------------|-----|---|
| 6 | Re-test die after correction | 6.1 | Conduct trial extrusions after correction of die, die support adjustment or process or temperature adjustment |
|   |                              | 6.2 | Return die to die manufacturer if faulty extrusions persist   |
|   |                              | 6.3 | Record adjustments to die on die design drawings ensuring correct feedback codes are used                     |
|   |                              | 6.4 | Record adjustments made to die support system, process and temperature settings                               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting of die design drawings
- supervising trial extrusions to ensure trial is conducted to die design specifications
- diagnosing faults on solid and hollow dies
- diagnosing faults on aluminium extrusions, including:
  - shape distortions
  - out of specification wall thickness
  - serrations or castellations on flanges
  - surface faults
  - shape changing from start to end of runout
- liaising with die designers, die makers and extruder operators on performance of new die

### Required knowledge

Required knowledge includes:

- aluminium extrusion die construction
- aluminium extrusion process
- the effects of nitriding and re-nitriding on tool performance

- requirements of AS/NZS 1866:1997 Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
- techniques for correcting solid and hollow dies
- die support system, including role and types of feeder plates, bakers, bolsters and spacers
- extruder components, including:
  - container
  - container liner
  - billet
  - die slide
  - pressure rings
  - platen
- hollow die components, including:
  - weld chamber
  - mandrel
  - die holder
  - weld feeds
  - bridges
  - ports
- die and extruder performance and adjustment records

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to take a systematic approach to testing a new aluminium extrusion die, including carrying out any required finishing off, conducting trial extrusions, identifying reasons for any faults in the trial extrusions and determining the appropriate action to remedy the fault.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- comply with relevant WHS, regulatory requirements and risk management
- correctly identify bearings, apertures, and critical measurements and tolerances on die drawing
- supervise and conduct trial extrusions
- use workshop machines and hand tools to finish

**Context of and specific resources for assessment**

- off a die to design specifications
- identify cause of extrusion faults from both hollow and solid die extrusions
- identify appropriate action to take to remedy extrusion faults
- report and document results.
- This unit must be assessed on the job with access to the extruder for which a new die has been designed.
- Assessment must cover the testing of both solid and hollow dies across a range of extrusion shapes.
- Assessment should cover sufficient trial extrusions to ensure that both shape and surface faults related to die performance are observed.
- The competencies covered by this unit would usually be demonstrated by an individual working in a team environment that includes extruder operators and die designers and die makers. The assessment environment should not disadvantage the candidate.
- This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with testing a new aluminium die.

**Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over a number of extrusions and at least one new solid and one new hollow die) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessment may be in conjunction with assessment of other units of competency where required.

### Guidance information for assessment

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Die support</b>	Die support is the specified toolstack dimensions that will support dies, according to the force the extruder can exert.
<b>Container</b>	The container is the part of the extruder that holds the billet and billet support components.
<b>Support tooling</b>	Support tooling is the name given to the various pieces of tooling (e.g. bolsters that provide stiffness to the die during extrusion).
<b>Die holder</b>	Die holders accommodate the diesets (feeder plate, die plate and backer). Die holders are the first components in toolstacks.
<b>Bolster</b>	Bolsters are deep discs of steel that provide stiffness in the toolstack to allow the die to remain flat and thus do its work properly. The term bolster includes any inserts designed to cut the cost of support tooling.
<b>Die slide</b>	The die slide is the part of the extruder that accommodates the dies and other tooling that makes up the toolstack.
<b>Toolstack</b>	The toolstack is the assembly of die, feeder plate and backer, holder and support tooling that fits into the die slide.
<b>Die</b>	The die is the part of the tooling that creates the extrusion shape as the metal is pressed through it.

<b>Bearing</b>	The die contains bearings of various lengths. Bearings are lands that act as frictional controls on metal flow. The bearing is an outline of the extrusion shape cut through the die to the highest precision possible.
<b>Feeder plate</b>	The feeder plate precedes the die and provides an additional degree of flow control. It is also described as a control plate. It is bolted to the die and backer, forming the dieset.
<b>Backer</b>	The die must be given support against the force needed to make metal flow. The first item of this support is the backer. Backer profiles are usually slightly larger than die apertures (precision cut) and are not high precision items.
<b>Platen plate</b>	The platen plate or pressure ring is set into the front wall of the extruder as a replaceable feature. Platen plates take up the forces applied to the toolstack and transmit them to the extruder structure.
<b>Primary and secondary bolsters</b>	<ul style="list-style-type: none"> <li>• Some larger extruders operate with a combination of single, one piece bolsters for special shapes and a split system of primary and secondary bolsters.</li> <li>• The primary bolster is usually deeper than the secondary and provides the main support. It is cut closer to the die aperture than the secondary bolster which closely follows the primary aperture so as to back it up.</li> <li>• Secondary bolsters are likely to be shared by several primary bolsters.</li> </ul>

## Unit Sector(s)

**Competency field** Machine and process operations

**Unit sector**

## Custom Content Section

Not applicable.



## MEM08001B Perform wire, jig and barrel load/unload work

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers loading barrels for mass finishing processes, undertaking jig work for non-electrolytic processes, undertaking wire jig and rack work for non-electrolytic processes, and unloading and removing jigs after finishing.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to loading and unloading in preparation for a wide variety of pre-treatment and finishing processes of multiples of similar items.</p> <p>Typical processes include degreasing, de-scaling, surface blasting, flame cleaning, wet blasting, grinding, polishing, wet coating, powder coating, electroplating, anodising, electroless plating, electrophoretic coating and hot dip metallising.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Load barrels etc., for mass finishing processes	1.1.Machinery is correctly loaded regarding load mass. 1.2.Machine access openings are safely secured.
2. Undertake jig work for non-electrolytic processes	2.1.Components are appropriately secured using standard operating procedures.
3. Undertake wire jig and rack work for electrolytic processes	3.1.Correct type and size of wire or rack is selected and inspected for conformance to specification. Damaged racks are identified for repair or replacement. 3.2.Components are secured presenting appropriate faces according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- correctly loading into the surface finishing machinery
- securing and positioning components to minimise damage
- securing machine access openings
- unloading and stacking components to minimise damage
- selecting the correct type and size of wire or rack
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- performing calculations using formulae

#### Required knowledge

Look for evidence that confirms knowledge of:

- the procedures for loading machinery for mass finishing processes
- the distribution of the components within the machinery
- reasons for distributing the components in a particular manner
- the procedures for securing machine access openings
- the consequences of not securing machine access openings
- the procedures for jiggling work for non-electrolytic processes
- the precautions to be taken when jiggling work for non-electrolytic finishing processes
- the appropriate types and sizes of wire or racks used in conjunction with surface finishing using electrolytic processes
- different faces to be surface finished/coated
- procedures for securing the components to be surface finished using electrolytic processes
- procedures for unloading and stacking surface finished components
- the damage that can be caused by inappropriate handling and storing of surface finished components
- hazard and control measures associated with wiring, jiggling and barrel load/unloading work
- safe workplace practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform wire, jig and barrel load/unload work related to non-electrolytic processes.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing wire, jig and barrel load/unload work related to non-electrolytic processes or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

**EVIDENCE GUIDE**

	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Non-electrolytic processes**

Pre-treatment and finishing processes typical of which are degreasing, de-scaling, surface blasting, flame cleaning, wet blasting, grinding, polishing, wet coating, powder coating, electroplating, anodising, electroless plating, electrophoretic coating and hot dip metallising

**Components**

Refer to components supplied by the customer

**Damaged racks**

- Damage to plastic coating or contact points
- Ensuring good electrical contact
- Positioning to facilitate optimum thickness on significant surfaces
- Avoidance of gas entrapment
- The position of contact marks

**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Surface finishing
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## MEM08002C Pre-treat work for subsequent surface coating

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers pre-treating common ferrous and non-ferrous work.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to pre-treatment of common ferrous and non-ferrous work for finishing by a wide variety of processes, such as wet coating, powder coating, electroplating, anodising, electroless plating, electrophoretic coating and hot dip metallising.</p> <p>In the pre-treatment process, adjustments to apparatus/equipment/controls include temperature settings, current/voltage and solution compositions.</p> <p>This unit should not be selected if Unit MEM08003C (Perform electroplating operations) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify job material	1.1.Common metals, alloys and non-metals can be identified.
2. Identify job surface condition	2.1.Common surface soils and conditions can be identified.
3. Perform pre-treatment processes in correct sequence	3.1.Pre-treatment processes are carried out to standard operating procedures. 3.2.Pre-treatment process parameters are monitored to ensure they remain within specified limits.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following routine and familiar information on standard operating procedures
- recognising common surface soils and conditions from given samples
- carrying out appropriate pre-treatment processes
- monitoring and maintaining the pre-treatment process parameters within specified limits
- following verbal instructions
- orally reporting routine information

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics of common metals, alloys and non-metals and procedures and techniques for identifying them
- common surface soils and conditions
- procedures for identifying the type(s) of soil on surfaces to be finished
- simple tests that can be used to assist in identifying surface soils and conditions
- pre-treatment processes applicable to a range of materials, surface soils and conditions
- procedures for carrying out pre-treatment processes
- parameters and procedures for monitoring pre-treatment processes
- hazards and control measures associated with pre-treatment
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to pre-treat common ferrous and non-ferrous materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with pre-treating common ferrous and non-ferrous materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Common metals</b>	Steel, copper, brass, zinc, cast iron, stainless steel
<b>Surface soils and conditions</b>	Oils, greases, drawing compounds, cutting lubricants, buffing lubricants, rust and scale
<b>Pre-treatment processes</b>	Solvent degreasing, alkaline cleaning, pickling, acid dipping
<b>Process parameters</b>	Temperature, time, currents, solution concentrate

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Surface finishing
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## MEM08003C Perform electroplating operations

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	
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### Application of the Unit

Application of the unit	<p>This unit applies to a range of metal plating processes in the electroplating, electronics, jewellery manufacture, and metal fabrication industries. It covers the general operation, monitoring and adjustment of manual, semi and automatic electroplating processes. It includes volume production and 'jobbing' involving rack and barrel type processes.</p> <p>This unit should not be selected if Unit MEM07025B (Perform advanced machine/process operation) has already been selected. Where simple operating and monitoring of the electroplating process is required, Unit MEM07024B (Operate and monitor machine/process) should be considered</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM08001B	Perform wire, jig and barrel load/unload work
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify electroplating requirements	1.1.Electroplating requirements are identified. 1.2.Untreated materials and required electroplating treatment are identified.
2. Prepare for electroplating process	2.1.Materials and racking arrangement are checked for non-conformance to specifications/job requirements. 2.2.All plant and equipment relevant to process are checked for compliance with safety and operational

ELEMENT	PERFORMANCE CRITERIA
	<p>requirements.</p> <p>2.3.Instrumentation/gauges are checked for operation.</p> <p>2.4.Condition of solution is checked.</p>
3. Perform electroplating operations	<p>3.1.Operation steps are carried out in correct sequence according to standard operating procedures or work instructions.</p> <p>3.2.Safety precautions are observed.</p>
4. Recognise and rectify process deviations	<p>4.1.Compliance with operating parameters is ensured.</p> <p>4.2.Uncontrollable variances are reported to appropriate persons.</p> <p>4.3.Adjustments are made to rectify process deviation.</p> <p>4.4.Finished products are visually inspected for compliance to specification.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- recognising deviations and faults in product/equipment/process
- identifying machine process requirements, untreated materials and process sequences
- identifying incorrectly loaded work
- inspecting job surface conditions
- checking plant and equipment for conformance to safety and operational requirements
- checking solution levels and identifying visible contamination such as solution clarity, oil, surface contamination
- maintaining required contacts and immersions while moving materials
- monitoring operating parameters, identifying deviations and making required adjustments
- adjusting settings such as voltage, current and temperature within permissible limits
- correcting deviations within scope operator's control
- reading and interpreting routine information on written job instructions,

**REQUIRED SKILLS AND KNOWLEDGE**

- specifications and standard operating procedures. May include drawings
- following oral instructions
  - performing calculations using formulae

**Required knowledge**

Look for evidence that confirms knowledge of:

- basic knowledge of electroplating process, machine components, treatment solutions, process parameters
- a basic knowledge of electroplating solutions and handling procedures
- treatment stages
- information relevant to plating products, treatment baths, settings
- characteristics of a variety of base materials that can be plated
- pre-treatment s, treatments and post treatments in relation to task requirements
- required equipment checks
- hazards and control measures associated with electroplating processes
- operational requirements of all plant and equipment associated with the relevant process
- the purpose and typical settings of different instruments/gauges
- sequences and requirements involved in moving materials
- the range of adjustments permissible for given operating parameters including voltage, current and temperature
- variances outside the control of the operator
- common faults and imperfections/deviations
- adjustments to suit specific process deviations
- effects of rust, corrosion and other contaminants
- the reasons for rejecting incorrectly loaded work
- safe operating procedures, safety and personal protective equipment, hazards of specific solutions

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to start up, operate and monitor an electroplating



<b>EVIDENCE GUIDE</b>	
	process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with starting up, operating and monitoring an electroplating process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Electroplating requirements</b>	Coating thickness, appearance, ductility, hardness, corrosion resistance, wear
<b>Untreated materials</b>	Steel, copper, brass, cast iron, stainless steel
<b>Electroplating treatment</b>	<ul style="list-style-type: none"> <li>• Pre-treatment</li> <li>• Electroplating operations</li> <li>• Post treatment</li> </ul>
<b>Checked</b>	Equipment checking includes componentry, electrodes, circuitry equipment
<b>Instruments and gauges</b>	<ul style="list-style-type: none"> <li>• Volt meters, AMP meters, temperature recorders/indicators</li> <li>• AMP per hour meters</li> </ul>
<b>Electroplating operations</b>	Engineering coatings, protective finishes, decorative plating
<b>Work instructions</b>	Standard operating procedures, verbal and written job instructions, job cards, specifications, drawings
<b>Adjustment</b>	Time, temperature, current density, voltage
<b>Visual inspection</b>	Surface texture, brightness, free from roughness, pitting, cracking, machining marks

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Surface finishing
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## MEM08004B Finish work using wet, dry and vapour deposition methods

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit applies to finishing work using a range of wet and dry organic coatings.
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### Application of the Unit

<b>Application of the unit</b>	<p>Processing may be carried out in manual, semi or fully automatic plant. Applications may be by hand or utilising a wide range of machines or plant.</p> <p>Work is conducted under supervision.</p> <p>Where straightforward monitoring of semi or automatic machine or process is undertaken, then Unit MEM07024B (Operate and monitor machine/process) should be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM08002C	Pre-treat work for subsequent

<b>Prerequisite units</b>		
		surface coating
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess and prepare components for required coating process	<p>1.1.Coating specifications are identified from operation sheets/work procedures.</p> <p>1.2.Suitability of pre-treated components for finishing process is checked according to enterprise procedures.</p> <p>1.3.Components are prepared as required for finishing application.</p> <p>1.4.Components are positioned/located for finishing according to enterprise procedures.</p>
2. Perform simple mixing and estimating operations	<p>2.1.Mixing ratios are calculated and a range of wet coatings are mixed and thinned as required to standard operating procedures.</p> <p>2.2.Required coating quantities are estimated using</p>

ELEMENT	PERFORMANCE CRITERIA
	simple surface area calculations.
3. Perform coating operation	<p>3.1. Equipment is set up to specification using standard operating procedures.</p> <p>3.2. Coating and applied curing technique are monitored to standard operating procedures.</p> <p>3.3. Coating application, thickness and colour are checked and maintained for compliance with specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant drawings, specifications and/or instructions in accordance with work place procedures
- racking the components to be coated correctly in accordance with standard operating procedures
- calculating the correct mixing ratios for given wet coatings accurately
- where appropriate, mixing and thinning the given wet coatings
- calculating the surface area to be coated correctly
- where appropriate, estimating the quantities of wet coating materials correctly
- setting up the appropriate coating equipment
- applying the coating correctly using the appropriate technique
- curing the coating correctly using the appropriate technique
- maintaining the coating thickness and colour in accordance with specifications throughout the coating operation
- checking the coating thickness and colour
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- checking for conformance to specifications
- performing numerical operations, geometry and calculations/formulae within the

**REQUIRED SKILLS AND KNOWLEDGE**

scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- work to be undertaken
- coating process to be used
- coating specifications
- appropriate type of racking for the coating process
- reasons for selecting the chosen rack type
- procedures for racking components to be coated
- source of data on mixing ratios for wet coatings
- mixing ratio for the given task(s)
- function of thinners as applied to the application of wet coatings
- procedures to be followed when mixing wet coatings
- surface area to be coated
- coverage rate of the coating material to be applied
- procedures for estimating quantities of coating materials
- types of equipment used for a variety of coating processes
- appropriate coating equipment for the given task(s)
- reasons for selecting the chosen equipment
- operating procedures applicable to the selected coating equipment
- a range of coating techniques
- a range of curing techniques
- appropriate coating and curing technique for the given task(s)
- reasons for selecting the chosen coating and curing techniques
- monitoring procedures to be followed
- examples of coating defects
- the causes of coating defects
- where appropriate, procedures for rectifying coating defects
- where appropriate, procedures for reporting coating defects
- coating thickness and colour to be achieved
- the means of checking coating thickness and colour
- frequency at which checks are undertaken
- hazards and control measures associated with finishing work using wet, dry and vapour deposition methods, including housekeeping
- safe work practices and procedures
- use of personal protective equipment

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to finish work using wet, dry and vapour deposition methods. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with finishing work using wet, dry and vapour deposition methods or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Coating**

Electrostatic powder coating, electrophoretic coating, industrial spray coating and lacquering, electroless (auto catalytic) nickel or copper plating, phosphating, chromating, galvanising, hot tinning, sputter deposition, vacuum evaporation, ion plating, paints, stains and other liquid finishes

**Prepared**

Visual inspection for contamination, masking out, racking, identification of correct materials to be used, ensuring cleanliness of work area and equipment, operational testing of equipment

**Coating operation**

Spray application, dip coating

**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Surface finishing
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## MEM08005B Prepare and produce specialised coatings

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking masking and jig work, determining operational parameters, and pre-treating and treating work.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to specialised production of industrial films on a variety of work pieces, often on a one-off basis. Typical of the coatings are heavy (hard) chromium or nickel, heavy electroless nickel, 'hard' anodising and selective (brush) plating. Also included is the electrodeposition of 'difficult' metals such as iron and certain alloys.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM08002C	Pre-treat work for subsequent surface coating

<b>Prerequisite units</b>		
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake mask and jig work	1.1.Jigs are secured and masking is adherent and stable. 1.2.Necessary auxiliary electrodes and shields are incorporated effectively. 1.3.Necessary jigs and shields are manufactured.
2. Determine operating parameters	2.1.Plating knowledge and/or specifications are applied in correctly computing operating times, currents and/or voltages.
3. Pre-treat and treat work	3.1.Work is treated in accordance with specifications using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- securing the electroplating jigs
- correctly masking
- setting up auxiliary electrodes and shields
- manufacturing jigs and shields in accordance with specifications
- correctly calculating the operating parameters
- treating the work
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- performing calculations using formulae

#### Required knowledge

Look for evidence that confirms knowledge of:

- the reasons for masking work being electroplated
- the range of materials that are used for masking purposes
- the procedures for securing the masking
- the reasons for using auxiliary electrodes and shields
- the procedures for mounting/setting up auxiliary electrodes and shields
- the specifications of the jigs and shields to be manufactured
- the procedures for manufacturing jigs and shields
- the procedures and formulae for calculating operating times, currents and voltages
- the specifications of the surface finish to be achieved
- the procedures for pre-treating the work
- the procedure for treating the work after electroplating
- the pre-electroplating and post electroplating treatment specifications
- the reasons for pre-electroplating and post electroplating treatment of surfaces
- hazards and control measures associated with preparing and producing specialised coatings electrolytically
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare and produce specialised industrial films on a variety of work pieces, often on a one-off basis. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing and producing specialised industrial films on a variety of work pieces, often on a one-off basis or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Auxiliary electrodes and shields</b>	<ul style="list-style-type: none"> <li>• Soluble auxiliary anodes</li> <li>• Insoluble auxiliary anodes</li> <li>• Bi polar electrodes</li> <li>• Shields</li> <li>• Robbers</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Surface finishing
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## MEM08006B Produce clear and/or coloured and/or sealed anodised films on aluminium

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing anodised coatings on aluminium
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of sealed anodised films on aluminium and its alloys. Films may be clear or coloured. Colouring is produced by dyeing or by 'in-bath' processes. Applications include electrical, decorative, mechanical and architectural purposes.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM08002C	Pre-treat work for subsequent surface coating

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform a series of anodising steps	1.1.All steps are carried out in the correct sequence to standard operating procedures. 1.2.Masking techniques are correctly applied, where required. 1.3.Contact marks and shielding are minimised.
2. Assess preparation of work for correct jigging/loading	2.1.Work is correctly connected for the required current flow and minimum contact marks and shielding. 2.2.All incorrectly loaded work is rejected.
3. Anodise work by a series of treatment steps	3.1.All steps are carried out in the correct sequence to standard operating procedures.
4. Seal or dye and seal anodised work	4.1.All steps on work are carried out in the correct sequence to standard operating procedures.
5. Monitor and control operating parameters	5.1.Process parameters are maintained within specified limits.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following routine and familiar information on standard operating procedures
- following all steps in the anodising process
- applying the correct masking materials and techniques
- minimising contact marks and shielding
- correctly connecting the work to the required electrical current
- identifying incorrectly loaded work
- maintaining process parameters within specified limits
- following verbal instructions
- orally reporting routine information

#### Required knowledge

Look for evidence that confirms knowledge of:

- process for anodising aluminium
- materials, techniques and procedures for masking materials during anodising
- causes of contact marks and shielding during the anodising process
- procedures for minimising contact marks and shielding
- procedures for connecting the work to the required electrical current
- the electrical current required for the anodising process
- methods for correctly loading work
- examples of incorrectly loaded work
- reasons for rejecting incorrectly loaded work
- steps to be carried out in the seal/dye and seal process
- procedures and reasons for monitoring and maintaining the process parameters within the specified limits
- hazards and control measures associated with anodising operations, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce clear and coloured and sealed anodised films on aluminium and its alloys for decorative, mechanical and architectural purposes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with anodising aluminium or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

## EVIDENCE GUIDE

**Guidance information for assessment**

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Anodising steps</b>	Pre treatment, anodising, dyeing, sealing
<b>Masking techniques</b>	Taping, waxing
<b>Process parameters</b>	Temperature, current density, time

## Unit Sector(s)

**Unit sector**

## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Surface finishing
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## MEM08007B Control surface finish production and finished product quality

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying the principles of quality assurance, applying research and quality information to the production process, and performing quality tests to industry standards.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to lifting and moving material manually and by basic mechanical handling devices/aids in a wide range of environments.</p> <p>Analyses are confined to the use of basic instruments such as pH meters, hydrometers, stalagmometers, laboratory balances.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Apply principles of quality assurance	1.1. Quality assurance standards are applied to enterprise specifications.
2. Apply research or quality data to production process	2.1. Liaison is undertaken with in-house/external control laboratories. 2.2. Data is correctly interpreted and process changes are recommended. 2.3. Process changes are effectively implemented. 2.4. Laboratory/research data is used to determine and make changes/corrections to processes.
3. Perform quality tests to industry standards	3.1. Quality testing is performed as required to standard operating procedures and industry standards.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting quality assurance standards, test data other applicable reference documents
- liaising between the production section and the control laboratory
- checking and clarifying information
- using effective communication skills and terminology for conveying and discussing task-related information
- determining and recommending process changes
- using tests to calculate process parameters on the basis of test and production data collected
- using appropriate tests, testing equipment and techniques to test the surface coating for conformance with specification

#### Required knowledge

Look for evidence that confirms knowledge of:

- enterprise and industry quality assurance standards that apply to surface finish production and product quality
- the role of the control laboratory and procedures for liaising with internal/external control laboratories
- surface finish specifications
- characteristics of deviations of test/production data and their causes
- the procedures, calculations and formulae for determining process parameters
- the effect of varying process parameters on the specification of the surface finish
- surface coating tests and the procedures, equipment and techniques necessary to carry out those tests
- hazards and control measures within the scope of this unit
- use and application of personal protective equipment
- safe work practices and procedures
- manual handling techniques

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to control surface finish production and finished product quality.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with controlling surface finish production and finished product quality or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for</b>	

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Quality testing**

Tests for hardness, adhesion, deposit stress, thickness, corrosion, resistance and appearance by checking coating thickness, appearance, corrosion resistance, adhesions, deposit stress

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units**

## Competency field

Competency field	Surface finishing
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## MEM08008B Operate and control surface finishing waste treatment process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers treating metal finishing effluent waters
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the purification of metal finishing effluent waters which typically contain cyanides, hexavalent chromium, heavy metal cations, certain anions, greases, etc.</p> <p>Methods used may include chemical treatments, grease entrapment, metals precipitation and separation, ion exchange, reverse osmosis and gas scrubbing; and involve full or partial recovery of waste waters and chemicals.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 3</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Load waste product	1.1.Waste from production process is obtained via established procedures. 1.2.Waste is loaded in accordance with standard operating procedures for waste/effluent.
2. Monitor plant for waste by-products	2.1.All process parameters are accurately monitored and recorded to identify waste/effluent. 2.2.Recording devices are checked for correct/continuous operation.
3. Adjust process	3.1.Knowledge of waste treatment processes is applied in determining appropriate adjustments. 3.2.Process parameters are checked to ensure they remain within specified limits. 3.3.All adjustments are made to accord with authority requirements with regard to waste. 3.4.In the event of mechanical failure, appropriate

ELEMENT	PERFORMANCE CRITERIA
	corrective action is undertaken.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing safe loading of waste
- monitoring process parameters
- recording process parameters
- checking recording devices for correct/continuous operation
- making adjustments to the waste treatment process
- checking process parameters for conformance to specification
- maintaining the condition of the waste in accordance with the requirements of the relevant authority
- taking corrective action in response to a mechanical failure
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- performing calculations using formulae

#### Required knowledge

Look for evidence that confirms knowledge of:

- the hazards and control measures associated with handling waste products
- the safety precautions to be taken when handling/loading the waste/effluent
- the process parameters to be monitored
- the procedures for monitoring process parameters and identifying waste/effluent
- the procedures for recording process parameters
- the procedures for checking process parameter recording devices
- the adjustments that can be made to the waste treatment process and their effect on the condition of the waste
- the procedures for adjusting process parameters
- the specified limits for each process parameter
- the legislative and regulatory requirements relating to waste management
- the corrective actions that can be taken and the reasons for taking proposed

**REQUIRED SKILLS AND KNOWLEDGE**

corrective actions

- the possible effects of surface finishing waste on the environment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to treat metal finishing effluent waters. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with metal finishing waste effluent treatment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples



**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Waste/effluent</b>	Rinse waters, spent solutions, spills, leaks
<b>Recording devices</b>	pH meter, oxidising/reduction/potential probes (redox), flow rate
<b>Waste treatment processes</b>	Neutralisation, metal precipitation, solid separation (gravity, centrifuging), oxidation, reduction, grease entrapment, ion exchange
<b>Process parameters</b>	Solution flow, pH, redox (oxidising /reduction/potential) which typically contain cyanides, hexavalent chromium, heavy metal cations, certain anions, greases, etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Surface finishing
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## MEM08009C Make up solutions

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers making up solutions and maintaining process specific equipment, such a probes and electrodes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to standard operational procedures for solution preparation including compliance with standards, codes, legislation, company and customer requirements. Maintenance of solution ratio and purity is covered by other units.</p> <p>This unit should not be selected if Unit MEM08018B (Electroplate engineering coatings), Unit MEM08019B (Electroplate protective finishes) and/or Unit MEM08020B (Electroplate decorative finishes) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial

<b>Prerequisite units</b>		
		chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare solution	1.1.Appropriate solutions for application requirements or specifications are identified. 1.2.Volumes, density and solution concentration are calculated for effective operation. 1.3.Suitable volume of solution is made up from supplier's instructions and/or manual in accordance with standard operating procedures. 1.4.Spent solutions are referred to waste treatment processing in accordance with standard operating procedures.
2. Maintain process specific equipment	2.1.Inspection of probes and electrodes is carried out and meter probes are recalibrated as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing operational plan
- calculating volumes and determining quantities required
- preparing appropriate solutions
- inspecting probes and electrodes
- calibrating meter probes
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- undertaking calculations using formulae
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting chosen sequence of operations
- solution concentrations
- procedures for making up solution
- procedures for inspecting probes and electrodes
- procedures for recalibrating meter probes
- the equipment and techniques necessary to recalibrate meter probes
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to make up solutions and maintain process specific equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with making up solutions or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units	

## Competency field

Competency field	Surface finishing
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## MEM08010B Manually finish/polish materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers finishing and polishing materials using a range of media and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the finishing of a wide range of products made from metals and plastics. This unit is not intended to apply to touch-up finishing related to maintenance or assembly activities. Examples of applications are pre-decorative and post decorative plating, jewellery production, component manufacture and machining and marine vessel construction.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select appropriate finishing/polishing procedure	<p>1.1.Surface finish specifications are understood and appropriate finishing/polishing method/technique is selected for the work requirements.</p> <p>1.2.Appropriate finishing/polishing equipment/media is selected for the work material and work requirements.</p>
2. Install and set up grinding and polishing devices	<p>2.1.Endless belt liners are fitted according to standard operating procedures.</p> <p>2.2.Grinding wheels and mops are fitted and dressed according to standard operating procedures.</p> <p>2.3.Polishing mops are installed and set up according to standard operating procedures.</p>
3. Identify job materials	3.1.Common metals, alloys and non-metals are identified.
4. Identify job surface condition	4.1.Common surface imperfections are identified.
5. Assess processing hazards associated with work piece size and shape	<p>5.1.Hazards are correctly identified.</p> <p>5.2.Correct safe working procedures are followed.</p>

ELEMENT	PERFORMANCE CRITERIA
6. Grind, finish, brush and/or polish job	6.1.Job surface is finished to specification according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following information on standard operating procedures
- checking and clarifying task-related information
- selecting appropriate polishing/finishing method to suit work requirements
- fitting and adjusting endless belts on finishing machines
- fitting and dressing grinding wheels and mops on pedestal grinders
- installing and setting up polishing mops in polishing machines
- producing surface finishes to specification
- identifying surface imperfections
- assessing processing hazards

#### Required knowledge

Look for evidence that confirms knowledge of:

- typical surface finish specifications within the scope of this unit
- procedures, tools and techniques for fitting and adjusting endless belts on finishing machines
- procedures, tools and techniques required to fit and dress grinding wheels and mops
- procedures tools and techniques for installing and setting up polishing mops
- characteristics of common metals, alloys and non-metals
- appropriate polishing media to be used in finishing/polishing for different types of materials
- effect of different types and grades of polishing media on the surface finish
- finishing and polishing methods/techniques
- reasons for selecting a specific method/technique
- common surface imperfections/defects
- surface imperfections/defects that can be removed/repaired by manual finishing/polishing procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for handling components with surface imperfections/defects that cannot be removed/repaired
- methods and techniques to check for conformance to specifications
- hazards associated with the manual finishing/polishing process
- personal protective clothing and equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to manually finish/polish materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with manually finishing/polishing materials or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Finish**

Brightness, texture, roughness comparison

**Finishing/polishing equipment**

Endless belt grinders; table finishers; pedestal grinders and polishers; felt wheels, fabric mops and brushes with underhand and overhand techniques; flexible drive appliances; buffing compounds; cutting compounds and abrasive belts

**Finishing/polishing media**

Solid and liquid compositions containing alumina, silicon carbide, diamond dust, tripoli, calcium oxide and iron oxides

**Material**

Cast iron, steel, zinc and its alloys, copper, aluminium and its alloys, bronzes, sterling silver,

RANGE STATEMENT	
	gold and plastics
<b>Common surface imperfections</b>	Pitted surface, machining lines, scale, rust
<b>Hazards</b>	Airborne dust inhalation, unsecured components

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM08011B Prepare surfaces using solvents and/or mechanical means

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting the appropriate preparation process, selecting and setting up the equipment, undertaking blasting or application of solvents as required, and checking the finished surface.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to surface preparation in new surfaces and in restoration work. Application of surface preparations can apply to metal and non-metal materials.</p> <p>Work is undertaken autonomously or as part of a team environment to established predetermined processes, practices and specifications including environmental requirements. All work and work practices are undertaken to regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Surface preparation requirements are determined from job sheet, instructions or other predetermined specifications in accordance with standard operating procedures.</p> <p>1.2.Where required, appropriate solvent and solvent application are selected to meet job specification.</p> <p>1.3.Where required, appropriate mechanical equipment is selected to meet job specification.</p> <p>1.4.Work site is prepared for surface cleaning activities.</p>
2. Set up equipment	2.1.Appropriate equipment and any required



ELEMENT	PERFORMANCE CRITERIA
	consumables are assembled, set up and prepared correctly and safely in accordance with manufactures' specifications and standard operating procedures.
3. Prepare surfaces using solvents as required	<p>3.1.Safe working environment for solvent use is established according to regulatory requirements and standard operating procedures.</p> <p>3.2.Solvents are applied correctly.</p> <p>3.3.Treated surface is neutralised and made safe to handle.</p>
4. Prepare surfaces using mechanical means as required	<p>4.1.Safe working environment for mechanical surface preparation is established according to regulatory requirements and standard operating procedures.</p> <p>4.2.Surfaces are prepared using mechanical means.</p> <p>4.3.Mechanical equipment is cleaned and checked for damage and operational faults, in accordance with standard operating procedures.</p> <p>4.4.Equipment faults are recorded and reported in accordance with standard operating procedures.</p>
5. Inspect prepared surface	<p>5.1.Surface preparation is checked for cleanliness and conformance to specifications.</p> <p>5.2.Faults or defects are rectified where required and recorded/reported in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing operations
- preparing surfaces using solvents as required
- preparing surfaces using mechanical means
- setting up equipment and consumables
- meeting all safety requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- using solvents correctly
- neutralising solvents
- using mechanical equipment to prepare surface
- maintaining mechanical equipment
- recording and reporting of faults
- inspecting prepared surface
- rectifying work performed
- checking for conformance to specifications
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instructions
- applying measurement skills needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- common surface contaminants, conditions
- reasons for selecting solvents
- mechanical equipment required
- procedure for setting up equipment
- specifications applying to the surface to be prepared
- methods for neutralising solvents
- tools, equipment, abrasives and other materials
- procedures for maintaining/storing mechanical equipment
- procedures for recording/reporting faulty equipment
- procedures checking prepared surfaces
- rectification techniques
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select the appropriate preparation process, select and set up the equipment, undertake mechanical preparation or application of solvents as required and inspect the finished surface. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with surface preparation using solvents and/or mechanical means, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for</b>	

**EVIDENCE GUIDE**

<b>assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Surface preparation**

New surfaces and restoration work

**Solvents**

A range of cleaning chemicals including acids, chlorinated solvents and hydrocarbons

**Solvent application methods**

Spraying, wiping, brushing, vapour degreasing etc.

**Mechanical equipment**

Linishers, grinders, polishers, sanders, blast device, enclosures, air grinders etc.

**Consumables**

Emery cloth/belts, grinding/sanding disks, grinding accessories etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Surface finishing
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## MEM08012B Prepare surfaces by abrasive blasting (basic)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing a basic level of skill in surface preparation by abrasive blasting.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to surface preparation/cleaning on both ferrous and non-ferrous masonry and cementitious materials/components. Reference is made to supplier information and specifications as well as accepted and appropriate Australian and international standards.</p> <p>The majority of work is in a team environment and uses predetermined procedures and standards for safety and quality with all work and work practices undertaken to regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM08016B	Control blast coating by-products, materials and emissions

<b>Prerequisite units</b>		
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1. Work requirements are determined from job sheet, instructions or other predetermined specifications in accordance with standard operating procedures.</p> <p>1.2. Appropriate abrasive blasting process, equipment and blasting media are identified to meet job specification.</p> <p>1.3. Work site is prepared for surface cleaning activities.</p>
2. Set up equipment	<p>2.1. Appropriate equipment and any required consumables are assembled, set up and prepared correctly and safely in accordance with manufactures' specifications and standard operating procedures.</p> <p>2.2. Correct rust inhibitor for use in wet abrasive blast methods is selected where required.</p>

ELEMENT	PERFORMANCE CRITERIA
	2.3.Pre-operational checks are carried out on equipment and faults and are rectified or reported for further action.
3. Prepare surfaces using abrasive blasting	<p>3.1.Blasting equipment is operated in accordance with standard operating procedures.</p> <p>3.2.Emergency shut-down procedures can be undertaken.</p> <p>3.3.Work procedures are undertaken to appropriate environmental requirements.</p> <p>3.4.Abrasive media disposal is carried out in accordance with standard operating procedures.</p> <p>3.5.Blasting equipment is cleaned and disassembled and inspected in accordance with manufacturers' specifications and standard operating procedures.</p> <p>3.6.Equipment faults are recorded and reported in accordance with standard operating procedures.</p>
4. Inspect prepared surface	<p>4.1.Surface preparation is assessed for cleanliness and conformance with specifications.</p> <p>4.2.Faults or defects are rectified where required and inspection results are recorded and reported in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing operations
- undertaking numerical operations within the scope of this unit
- selecting blasting equipment and media
- setting up equipment and consumables
- selecting rust inhibitor
- conducting pre-operational checks
- preparing surfaces using abrasive blasting
- disposing of abrasive media



**REQUIRED SKILLS AND KNOWLEDGE**

- maintaining blasting equipment
- identifying, recording and reporting of faults
- inspecting prepared surface
- performing rectification work
- checking for conformance to specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- reason for selecting the chosen sequence of operations
- blasting equipment and media required
- equipment, consumables for various methods
- importance of using an appropriate rust inhibitor
- process for undertaking pre-operational checks
- procedures for using abrasive blasting equipment
- procedures for abrasive media disposal
- procedures for maintaining and storing blasting equipment
- recording/reporting procedures; faulty equipment
- checking prepared surfaces
- rectification techniques
- safe work practices and procedures
- hazards and control measures related to abrasive blasting

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare surfaces by abrasive blasting (at a basic level). Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing surfaces by abrasive blasting (basic) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Blasting processes</b>	Surface preparation using propelled abrasives including water, air steam, grits and blasting mediums
<b>Blasting media</b>	Abrasives, shot, glass beads, sand, steel shot, garnet, and other mediums accepted by industry and all regulatory bodies
<b>Rust inhibitor</b>	A substance which, when added to a corrosive liquid in small amounts, reduces the rate of corrosion
<b>Blasting equipment</b>	Electric and diesel compressors, blast pots, blast rooms, centrifugal blast machines, water pressure washers to 35,000 kpa, air hoses and nozzles, and specified hand and power tools, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM08013B Prepare surfaces by abrasive blasting (advanced)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing an advanced level of skill in surface preparation using abrasive blasting.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed to be used where an advanced level of skill is desired in surface preparation using abrasive blasting.</p> <p>The operation and maintenance of compressed air systems and associated items, including emergency shut-down procedures, is included.</p> <p>Work is undertaken autonomously or as part of a team environment using accepted standards for safety, quality and procedures.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM08012B	Prepare surfaces by abrasive blasting (basic)
	MEM08016B	Control blast coating by-products, materials and emissions
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Work requirements are determined from job sheet, instructions or other specifications in accordance with standard operating procedures. 1.2. Appropriate abrasive blasting process and equipment are selected to meet job specification. 1.3. Appropriate abrasive blasting media and equipment are selected to meet job specification. 1.4. Work site is prepared for surface cleaning activities.
2. Set up equipment	2.1. Appropriate equipment and any required

ELEMENT	PERFORMANCE CRITERIA
	<p>consumables are assembled, set up and prepared correctly and safely in accordance with manufacturers' specifications and standard operating procedures.</p> <p>2.2. Correct rust inhibitor for use in wet abrasive blast methods is selected where required.</p> <p>2.3. Pre-operational checks are carried out on equipment and faults are rectified or reported for further action.</p>
3. Inspect surface prior to cleaning	<p>3.1. Work piece is inspected prior to cleaning in accordance with standard operating procedures.</p> <p>3.2. Identified faults/defects requiring remedial or pre-treatment action are reported as required.</p>
4. Prepare surfaces using abrasive blasting	<p>4.1. Blasting equipment is operated in accordance with standard operating procedures.</p> <p>4.2. Emergency shut-down procedures can be carried out.</p> <p>4.3. Work procedures are undertaken to appropriate environmental requirements.</p> <p>4.4. Abrasive media disposal is carried out in accordance with standard operating procedures.</p> <p>4.5. Blasting equipment is cleaned and disassembled and inspected in accordance with manufacturers' specifications and standard operating procedures.</p> <p>4.6. Equipment faults are recorded and reported in accordance with standard operating procedures.</p>
5. Inspect prepared surface	<p>5.1. Surface preparation is assessed for cleanliness and conformance with specifications.</p> <p>5.2. Faults or defects are rectified where required and inspection results are recorded and reported in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- preparing and sequencing operational work plan
- selecting blasting process and equipment
- selecting appropriate blasting media
- setting up equipment
- undertaking surface inspection prior to cleaning
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures.
- following verbal instructions
- orally reporting routine information
- identifying faults and defects
- checking and clarifying task-related information
- checking for conformance to specifications

### Required knowledge

Look for evidence that confirms knowledge of:

- calculations and numerical operations within the scope of this unit
- blasting media features
- equipment for the selected method
- inspection procedures
- procedures for using abrasive blasting equipment
- procedures for abrasive media disposal
- safe work practices and procedures
- hazards and control measures associated with preparing surfaces by abrasive blasting, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare surfaces by abrasive blasting (at an advanced level). Competency in this unit cannot be claimed until all prerequisites have been satisfied.



<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing surfaces by abrasive blasting (advanced) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Blasting process</b>	Wet, dry, vacuum automatic rotary, centrifugal and water blasting (including HP and UHP)
<b>Blasting media</b>	Garnet, ilmenite, slags, steel grit, steel shot, water, glass bead and soda
<b>Equipment</b>	Blast nozzles, compressors, blast and helmet ventilation, air hoses, blast pots, nozzles, safety equipment etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

**Competency field**

<b>Competency field</b>	Surface finishing
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## MEM08014B Apply protective coatings (basic)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers spraying pre-treatments and protective coatings not limited to brush, roller and conventional spray equipment, at a basic level.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed to be used where a basic level of skill is required. It covers single and two-pack coatings not containing isocyanates.</p> <p>Work is undertaken autonomously or as part of a team environment using predetermined standards of safety, quality and operating procedures.</p> <p>Specific health and safety matters include interpretation of MSDS warnings, materials sensitivity, hazardous goods, breathable air and introduction of compressed air into the body.</p> <p>Specific understanding is required of given supplier information and product details. Reference is made to supplier information and specifications as well as accepted and appropriate Australian and international standards.</p> <p>Where isocyanates are present, Unit MEM08015B (Apply protective coatings [advanced]) should be selected.</p> <p>Where required, Unit MEM11004B (Undertake dogging) and Unit MEM11010B (Operate mobile load shifting equipment) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Work requirements are determined from job sheet, instructions, drawings or visual inspection. 1.2. Required protective coating materials are identified according to job specification. 1.3. Required protective coating application equipment is

ELEMENT	PERFORMANCE CRITERIA
	<p>identified according to job requirements.</p> <p>1.4. Work site is prepared for application of protective coating.</p>
2. Work piece prepared for application of protective coating	<p>2.1. Surface condition is inspected for readiness for application of protective coating according to specification.</p> <p>2.2. Unsuitable work pieces/surfaces and fabrication defects are identified and appropriate remedial action or reporting is undertaken in accordance with standard operating procedures.</p> <p>2.3. Components are masked where protective coating application is not specified.</p> <p>2.4. Conditions for overspray are identified.</p>
3. Equipment prepared for application of surface coating materials	<p>3.1. Required plant and equipment basic operations are understood.</p> <p>3.2. Routine maintenance is undertaken on plant and equipment in accordance with standard operating procedures.</p> <p>3.3. Status/reports are recorded by proforma or orally in accordance with standard operating procedures.</p> <p>3.4. Conventional coating application equipment is assembled in accordance with equipment requirements and standard operating procedures.</p>
4. Apply single pack coatings	<p>4.1. Coating product type, solvent, uses, mixing procedure, clean-up and safety requirements are identified as appropriate.</p> <p>4.2. Correct method of determining wet film thickness in accordance with specified dry film is demonstrated.</p> <p>4.3. Coating material is thinned to suit the application method and to achieve required film thickness.</p> <p>4.4. Coating is applied using specified application method and standard operating procedures.</p> <p>4.5. Coating schedules can be outlined for metal and non-metal materials.</p> <p>4.6. Coating application and curing technique are monitored according to standard operating procedures.</p>
5. Clean and store equipment	<p>5.1. Conventional coating application equipment is cleaned, disassembled and inspected for damage.</p> <p>5.2. Faulty equipment is recorded and reported to appropriate personnel in accordance with standard</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>operating procedures.</p> <p>5.3.Coating application equipment is stored in accordance with standard operating procedures.</p>
6. Inspect finish surface	<p>6.1.Surface finish is assessed for profile size differences and uses.</p> <p>6.2.Coating thickness is determined using appropriate instruments and results are compared with job specifications.</p> <p>6.3.Total surface is inspected for conformance to specification in accordance with standard operating procedures.</p> <p>6.4.Inspection results are recorded and reported in accordance with standard operating procedures.</p>
7. Select and maintain personal protective equipment (PPE)	<p>7.1.Appropriate personal protective equipment for coating application is selected according to job requirements and standard operating procedures.</p> <p>7.2.Personal protective equipment is used appropriately in accordance with manufacturers' specifications and standard operating procedures.</p> <p>7.3.Ancillary support attachments are identified and used.</p> <p>7.4.Personal protective equipment is maintained in accordance with manufacturers' specification and standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant drawings, job sheets, specifications and instructions in accordance with workplace procedures
- considering all relevant information and job requirements
- preparing site with due regard to OH&S requirements including site safety, clear working space, other materials/structures/personnel in the vicinity, isolation of work site where required

**REQUIRED SKILLS AND KNOWLEDGE**

- undertaking comprehensive inspection and considering specifications during inspection
- using standard workplace procedures to identify, select and apply the appropriate treatment or actions to rectify items with surface or fabrication defects
- identifying surface required as 'no paint areas' and protecting these using standard masking procedures and techniques
- undertaking precautions to prevent overspray in the workplace using standard procedures
- undertaking routine maintenance on plant and equipment in accordance with standard operating procedures
- preparing all required maintenance records/reports and details communicated
- assembling equipment in accordance with manufacturers' specifications and standard operating procedures
- identifying coating type and appropriate solvents and standard workplace procedures required for mixing processes, clean-up and safe handling
- using workplace procedures for determining the wet film thicknesses of a coating from the specified dry film thickness
- calculating required thickness in accordance with product volume solids
- applying standard operating procedures for thinning coating materials and applying the specified film thickness coating to a substrate
- applying protective coating to comply with an established standard using specified methods and standard operating procedures
- controlling coating application and curing techniques using standard operating procedures
- undertaking disassembly, cleaning and checking for functionality of spraying equipment and associated items in accordance with standard operating procedures
- using standard operating procedures to report on any damage or faulty parts and communicating with appropriate personnel
- following procedure for storage including any hazard reduction and/or protection of equipment and components
- checking surface condition of the work piece, including profile size properties and problems according to standard operating procedures and other acceptable standards
- determining thickness using mechanical, electronic or other appropriate instruments and testing results compared with job specifications, drawings etc.
- undertaking comprehensive inspection as required by standard operating procedures
- preparing all required inspection records/reports and details communicated
- selecting personal protective equipment suitable for applying protective coatings
- using appropriate personal protective equipment in workplace operations in accordance with standard procedures
- selecting the appropriate supports to use with personal protective equipment in standard operational practices

## REQUIRED SKILLS AND KNOWLEDGE

- checking personal protective equipment items for serviceability in accordance with manufacturers' specifications
- recording and reporting faulty items to appropriate personnel using standard workplace procedures

### Required knowledge

Look for evidence that confirms knowledge of:

- work to be undertaken and specifications applying to the work
- correct interpretation of all relevant information
- safety issues, adequate precautions, awareness of other site factors that could be affected by the work
- deviation from specified surface finish/condition
- standard workplace procedures for identifying unsuitable work items
- method of locating areas to be protected from coating process and masked
- the areas subject to overspray and requiring protection
- operation of plant and equipment using standard operating procedures
- standard operating procedures for plant and equipment maintenance
- the requirements for completion and processing of maintenance reports
- assembly specifications and procedures
- workplace procedures for identifying coating types and processing solvents, mixing and safe handling practices
- the workplace procedures for determining the wet film thickness of a coating from the specified dry film thickness
- calculations using a specified formulation
- standard operating procedure for thinning coating materials for use in applying the specified film thickness coating to a substrate
- standard operating procedures to apply protective coatings to comply with an established standard
- procedures for controlling coating application and curing techniques
- standard operating procedure for disassembly, cleaning and checking
- standard operating procedures for recording and reporting defective parts
- standard operating procedures for storage and protection of equipment
- standard operating procedures and other relevant standards for assessing the profile of the surface finish
- dry film thickness testing instruments
- standard operating procedures for surface inspection, including the extent and detail of inspection as required
- requirements for completion and processing of inspection reports
- standard procedure for identifying and selecting the required personal protective equipment
- the workplace standard procedure for the use of personal protective equipment



**REQUIRED SKILLS AND KNOWLEDGE**

- the use and selection of appropriate supports to use with personal protective equipment in standard operational practices
- standard procedures and manufacturers' specifications for inspecting and maintaining personal protective equipment in the workplace
- hazard and control measures associated with applying protective coatings (basic) including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to apply protective coatings (basic). Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying protective coatings (basic) or other units requiring the exercise of the skills and knowledge

<b>EVIDENCE GUIDE</b>	
	covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Personal protective equipment</b>	Includes hand protection, full body protection, respirators, air fed hoods and foot protection. Noise and heat protection may also be necessary

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Surface finishing
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## MEM08015B Apply protective coatings (advanced)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit applies to spraying pre-treatments and protective coatings including conventional, two pack, plural component.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is for use when an advanced level of skill is required. It includes inspection and interpretation of the results using all current industry knowledge and equipment. Test equipment included but not limited to Holiday and Pin Hole testing, wet and dry film thickness gauges, temperature, relative humidity and dew point, hardness, gloss, adhesion and cure testing and soluble salts.</p> <p>Reference is made to supplier information and specifications as well as accepted and appropriate Australian and international standards. All work and work practices undertaken to regulatory and legislative requirements.</p> <p>For application of basic single and two pack coatings not containing isocyanates, Unit MEM08014B (Apply protective coatings [basic]) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM08014B	Apply protective coatings (basic)
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1. Work requirements are determined from job sheet, instructions or other specifications in accordance with standard operating procedures.</p> <p>1.2. Appropriate coating system and material is selected to meet job specification.</p> <p>1.3. Appropriate coating process and equipment is selected to meet job specification.</p> <p>1.4. Work site is prepared for surface coating activities.</p>
2. Work piece prepared for application of	2.1. Surface condition is inspected for readiness for application of protective coating according to

ELEMENT	PERFORMANCE CRITERIA
protective coating	<p>specification.</p> <p>2.2. Unsuitable work pieces/surfaces and fabrication defects are identified and appropriate remedial action or reporting is undertaken in accordance with standard operating procedures.</p> <p>2.3. Components are masked where protective coating application is not specified.</p> <p>2.4. Conditions for overspray are identified.</p>
3. Equipment is prepared for application of surface coating materials	<p>3.1. Required plant and equipment basic operations are understood.</p> <p>3.2. Routine maintenance is undertaken on plant and equipment in accordance with standard operating procedures.</p> <p>3.3. Status/reports are recorded by proforma or orally in accordance with standard operating procedures.</p> <p>3.4. Coating application equipment is assembled in accordance with equipment requirements and standard operating procedures.</p> <p>3.5. Personal protective equipment is selected and maintained in accordance with manufacturers' specifications and standard operating procedures.</p>
4. Apply coatings using conventional, airless and plural component equipment	<p>4.1. Coating product type, solvent, uses, mixing procedure, clean-up and safety requirements are identified as appropriate.</p> <p>4.2. Correct method of determining wet film thickness in accordance with specified dry film is demonstrated.</p> <p>4.3. Coating material is thinned to suit the application method and to achieve required film thickness.</p> <p>4.4. Coating is applied using specified application method and standard operating procedures.</p> <p>4.5. Coating application and curing technique is monitored according to standard operating procedures.</p>
5. Clean and store equipment	<p>5.1. Coating application equipment is cleaned, disassembled and inspected for damage.</p> <p>5.2. Faulty equipment is recorded and reported to appropriate personnel in accordance with standard operating procedures.</p> <p>5.3. Coating application equipment is stored in accordance with standard operating procedures.</p>
6. Inspect finished	6.1. Surface finish is assessed for profile size differences

ELEMENT	PERFORMANCE CRITERIA
surface	<p>and uses.</p> <p>6.2.Coating thickness is determined using appropriate instruments and results are compared with job specifications.</p> <p>6.3.Total surface is inspected for conformance to specification in accordance with standard operating procedures.</p> <p>6.4.Inspection results are recorded and reported in accordance with standard operating procedures.</p>
7. Calculate, estimate and cost application of protective coating	<p>7.1.Surface area of work piece, materials, labour and equipment are assessed.</p> <p>7.2.Cost of materials, labour, handling and equipment are determined.</p> <p>7.3.Results are recorded and reported as an estimate for the application of a protective coating system.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant drawings, job sheets, specifications and instructions in accordance with work place procedures
- where appropriate, inspecting the surface(s) to be coated by the individual
- selecting correct coating system and material for the job surface and use
- selecting correct coating process and equipment for applying the selected coating material
- preparing site with due regard to OH&S requirements including site safety, clear working space, other materials/structures/personnel in the vicinity, isolation of work site where required
- using standard workplace procedures to identify, select and apply the appropriate treatment or actions to rectify items with surface or fabrication defects
- identifying surfaces required as 'no paint areas' and protecting these using standard masking procedures and techniques
- undertaking precautions to prevent overspray in the workplace using standard procedures

## REQUIRED SKILLS AND KNOWLEDGE

- undertaking routine maintenance on plant and equipment in accordance with standard operating procedures
- preparing all required maintenance records/reports and communicating details
- assembling equipment in accordance with manufacturers' specifications and standard operating procedures
- selecting appropriate personal protective equipment and maintaining this in accordance with job requirements, manufacturers' specifications, OH&S requirements and standard operating procedures
- inspecting work piece and identifying any faults in accordance with standard operating procedures
- using workplace procedures for determining the wet film thickness of a coating from the specified dry film thickness
- calculating required thickness in accordance with product volume solids
- applying standard operating procedures for thinning coating materials and applying the specified film thickness coating to a substrate
- applying protective coating to comply with an established standard using specified methods and standard operating procedures
- controlling coating application and curing techniques using standard operating procedures
- undertaking disassembly, cleaning and checking for functionality of spraying equipment and associated items in accordance with standard operating procedures
- using standard operating procedures to report on any damage or faulty parts and communicating with appropriate personnel
- following procedure for storage including any hazard reduction and/or protection of equipment and components
- checking surface condition of the work piece, including profile size properties and problems according to standard operating procedures and other acceptable standards
- determining thickness using mechanical, electronic or other appropriate instruments
- comparing test results with job specifications, drawings etc.
- undertaking inspection comprehensively as required by standard operating procedures
- preparing all required inspection records/reports and communicating details
- using appropriate inspection and assessment methods
- undertaking calculations in accordance with standard operating procedures and specifications
- recording and reporting calculated costs in accordance with standard operating procedures

## Required knowledge

Look for evidence that confirms knowledge of:



**REQUIRED SKILLS AND KNOWLEDGE**

- work to be undertaken
- specifications applying to the work
- appropriate coating system and material required to meet job specification
- features of the various types of coating materials, including drying and curing requirements
- selection procedures for coating material
- appropriate coating process and equipment required for surface coating to meet job specification
- application features of the various types of coating materials and methods
- selection procedures for coating process and equipment, including conventional, airless and plural component
- awareness of other site factors that could be affected by the work
- deviation from specified surface finish/condition
- standard workplace procedures for identifying unsuitable work items
- method of locating areas to be protected from coating process and masked
- the areas subject to overspray and requiring protection
- operation of plant and equipment using standard operating procedures
- standard operating procedures for routine maintenance of plant and equipment
- requirements for completion and processing maintenance reports
- procedure for selecting and maintaining personal protective equipment
- inspection procedure
- unsuitable work pieces in consideration of job specifications
- the workplace procedures for determining wet film thickness of a coating from the specified dry film thickness
- calculations using a specified formulation
- standard operating procedures for thinning coating materials for use in applying the specified film thickness coating to a substrate
- standard operating procedures to apply protective coatings to comply with an established standard
- the procedures for controlling coating application and curing techniques
- standard operating procedure for disassembly, cleaning and checking
- standard operating procedures for recording and reporting defective parts
- standard operating procedures for storage and protection of equipment
- standard operating procedures and other relevant standards for assessing the profile of the surface finish
- dry film thickness testing instruments
- standard operating procedures for surface inspection, including the extent and detail of inspection as required
- the requirements for completion and processing of inspection reports
- the standard methods and procedures for determining surface area of various shapes of materials

**REQUIRED SKILLS AND KNOWLEDGE**

- standard procedures for calculating costs
- the standard operating procedures for recording and reporting calculated costs
- hazard and control measures associated with applying protective coatings (advanced), including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to apply protective coatings (advanced). Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying protective coatings (advanced) or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Surface finishing
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## MEM08016B Control blast coating by-products, materials and emissions

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying, evaluating and controlling blaster coating by-products, materials and emissions.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to common containment practices and regulatory waste removal processes, documentation and implementation related to blaster coating by-products, materials and emissions in accordance with regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply specific health and safety considerations to surface preparation	1.1.Products, hazardous materials and processes used in blaster cleaning and coating operations are identified. 1.2.Safety procedures appropriate to the work requirements are applied. 1.3.Unsafe working conditions are identified and reported to appropriate personnel.
2. Control by-products, materials and emissions	2.1.By-products, materials and emissions are contained using established procedures. 2.2.By-products, materials and emissions are monitored and directed to appropriate treatment or storage area. 2.3.Monitoring devices are checked for correct/continuous operation. 2.4.Status/reports are recorded and reported.
3. Dispose of by-product, materials and emissions	3.1.Waste treatment processes are applied in accordance with standard operating procedures. 3.2.Treatment processes are carried out in accordance with standard operating procedures and to meet relevant authority waste requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- collecting, storing and removing samples of by-products
- monitoring and transferring by-product and emissions
- checking monitoring devices
- implementing waste treatment process
- recording and reporting of all results
- collecting, storing, removing and sampling by-products

#### Required knowledge

Required knowledge

- Look for evidence that confirms knowledge of:
- products, hazardous materials and processes within the scope of this unit
- regulatory and legislative requirements relating to control of blast coating by-products, materials and emissions
- procedures for collecting samples
- by-product collection equipment operation methods
- waste control monitoring equipment and procedures
- waste treatment processes
- requirements and procedures for recording and reporting process status reports
- hazards and control measures associated with controlling blast coating by-products, materials and emissions
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with controlling blast coating by-products, materials and emissions or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Context of and specific resources for assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Method of assessment</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Products, hazardous materials and processes</b>	All products, hazardous materials and processes that are subject to codes and/or regulations in use
<b>Monitoring devices</b>	pH meters, probes
<b>Waste treatment processes</b>	Neutralisation, metals precipitation, solid separation-gravity/centrifuging

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Surface finishing
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## MEM08018B Electroplate engineering coatings

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying engineering metallic/ceramic coatings to ferrous and non-ferrous metals and some non-metallic materials e.g. plastics.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to producing engineering coatings designed to promote wear resistance, protect against corrosion, reclaim worn components. It also applies to manufacturing components (electroforming).</p> <p>For surface preparation operations, Unit MEM08011B (Prepare surfaces using solvents and/or mechanical means) and Unit MEM08012B (Prepare surfaces by abrasive blasting [basic]) should be selected as appropriate.</p> <p>Straightforward operation of electroplating process is covered by Unit MEM08003C (Perform electroplating operations).</p> <p>Where pre-treatment operations only are carried out, Unit MEM08002C (Pre-treat work for subsequent surface coating) should be selected.</p> <p>For basic inspection of completed or partly completed products produced by others, Unit MEM15004B (Perform inspection) should be selected.</p> <p>For construction of anodes, shields/robbars etc., the appropriate fabrication units should be selected.</p> <p>Where dogging/lifting is undertaken, the appropriate materials handling units should be selected.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM08001B	Perform wire, jig and barrel load/unload work
	MEM08003C	Perform electroplating operations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select treatments and processes/equipment for producing engineering finishes	1.1.Appropriate treatment processes are selected according to base metal type, surface condition and relevant job specifications. 1.2.Operating/process parameters are selected to achieve required coating. 1.3.Appropriate equipment is selected.
2. Prepare work for engineering finishes	2.1.Products are correctly masked (stopped off) for selective plating. 2.2.Where applicable, conforming anodes are constructed and fitted correctly. 2.3.Where applicable, shields and robbers are constructed and fitted. 2.4.Pre-treatment processes are carried out, where applicable.
3. Monitor and control operating conditions and processes for engineering coatings	3.1.Operating/process parameters are set to produce required surface conditions/specifications. 3.2.Surface conditions of finished components are monitored and confirmed and abnormalities are identified. 3.3.Corrective actions are taken to rectify non-conforming conditions.
4. Maintain solutions for engineering finishes	4.1.Solution compositions are checked and confirmed to specification/operating range. 4.2.Adjustment requirements/additions are determined. 4.3.Additions are made to adjust solution composition to correct operating range.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in:

**REQUIRED SKILLS AND KNOWLEDGE**

- selecting treatments and processes/equipment for producing engineering finishes
- preparing work for engineering finishes
- calculating process parameters
- determining current densities
- assessing material condition for suitability for plating
- selecting equipment, masking, materials
- correctly sizing positioning and securing anodes
- sizing, positioning and securing shields and robbers
- carrying out mechanical/chemical pre-treatment
- setting times voltages/currents and temperature
- monitoring and controlling operating conditions and processes for engineering coatings
- maintaining solutions for engineering finishes

**Required knowledge**

Look for evidence that confirms knowledge of:

- effects of plating process on different materials
- conditions affecting engineering finishes
- base metal types
- surface finish of untreated material
- mechanical/chemical and specialised pre-treatment processes
- process parameters for achieving different coatings
- characteristics of different surface finishes
- masking materials and masking techniques
- safe operation of equipment to produce engineering finishes
- current distribution principles
- methods of constructing/fabricating, fitting anodes
- current-capacity of conforming/auxiliary anodes
- the role, construction, properties, applications, and positioning of shields and robbers
- finish requirements, permissible tolerances
- the causes of abnormalities and their related corrective actions
- purpose and application of simple tests including pH, titration, density
- calculations related to additions/adjustments to solution and of product surface area
- safe work practices and procedures, including handling chemicals

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply electroplate engineering coatings. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with applying electroplate engineering coatings or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Treatment processes</b>	Electroplating, electroforming, electroless plating
<b>Operating/process parameters</b>	Treatment times and currents, bath pH temperatures and densities, anode conditions, addition agent content, cleanliness of contacts etc., make-up, maintenance of solution levels and purity
<b>Coating</b>	Hard chroming, heavy nickel, electroless nickel, nickel composites, heavy deposits of nickel, copper, bronze up to 10 mm
<b>Equipment</b>	Wire racks, handling equipment, barrels, jigs, shields, robbers, etc.
<b>Products</b>	Base materials such as cast iron, brass, steels with machine welded sections, etc.
<b>Masking materials</b>	Wax, lacquers, tapes, foils
<b>Anodes</b>	Soluble, insoluble auxiliary anodes, etc.
<b>Solution compositions</b>	Cleaning, pickling, electroplating, chromate, acid dips
<b>Checks</b>	Density, titration, pH
<b>Adjustment</b>	Strength of solutions, temperature range



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Surface finishing
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## MEM08019B Electroplate protective finishes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying protective finishes to a range of ferrous and non-ferrous materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to pre-treatment and application of protective finishes to a range of ferrous and non-ferrous materials using electroplating.</p> <p>Use of plating techniques, solutions and compositions for protective finishes, recognition and assessment of impurities and imperfections and associated corrective actions are integral to all applications.</p> <p>This unit applies to electroplating decorative finishes to household fittings, hardware, artefacts and accessories.</p> <p>Processing may apply to manual, semi or fully automatic still or barrel plating environments and may include volume production and 'one-off' components. Use of plating techniques, solutions and compositions for protective finishes, recognition and assessment of impurities and imperfections and associated corrective actions are integral to all applications.</p> <p>For surface preparation operations, Unit MEM08011B (Prepare surfaces using solvents and/or mechanical means) and Unit MEM08012B (Prepare surfaces by abrasive blasting [basic]) should be selected as appropriate.</p> <p>Straightforward operation of electroplating process is covered by Unit (MEM08003C Perform electroplating operations).</p> <p>Where pre-treatment operations only are carried out, Unit MEM08002C (Pre-treat work for subsequent surface</p>
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	<p>coating) should be selected.</p> <p>For basic inspection of completed or partly completed products produced by others Unit MEM15004B (Perform inspection) should be selected.</p> <p>Where dogging/lifting is undertaken, the appropriate materials handling units should be selected.</p> <p>For construction of anodes, shields/robbars etc., the appropriate fabrication units should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM08001B	Perform wire, jig and barrel load/unload work
	MEM08003C	Perform electroplating operations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select treatments and processes/equipment for producing protective finishes	<p>1.1.Treatment processes are selected appropriate to the work requirements.</p> <p>1.2.Process parameters are selected to achieve required finish.</p> <p>1.3.Appropriate equipment is selected to achieve specified finish.</p>
2. Monitor and control protective finish processes and operating conditions	<p>2.1.Operating/process parameters are set to produce required protective finish/specifications.</p> <p>2.2.Surface condition of finished components is monitored and confirmed and abnormalities are identified.</p> <p>2.3.Corrective actions are taken to rectify non-conforming conditions.</p> <p>2.4.Pre-treatment processes are carried out, where applicable.</p>
3. Maintain solutions for protective finishes	<p>3.1.Solution compositions are checked and confirmed to specification/operating range.</p> <p>3.2.Adjustment requirements/additions are identified.</p> <p>3.3.Additions are made to adjust solution composition to correct operating range.</p> <p>3.4.Purification procedures are carried out as necessary.</p> <p>3.5.Anodes are maintained to ensure correct operation.</p>
4. Maintain equipment for protective finishes	<p>4.1.Performance of ancillary equipment is checked and remedial actions are taken as necessary.</p> <p>4.2.Electrical contacts are maintained.</p>

ELEMENT	PERFORMANCE CRITERIA
	4.3.Process transfer equipment is maintained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- monitoring and maintaining:
  - conformance to thickness specifications
  - anode/cathode ratio
  - impurities/contamination
  - performance of various ancillary equipment
  - condition of electrical contacts
  - condition of racks, jigs and barrels
  - condition of rack coating
  - cathode contacts
- assessing material condition for suitability for plating
- calculating/measuring:
  - current and processing time
  - concentration and pH of solutions
  - required chemical/solution additions
- making selections of:
  - correct treatment processes
  - correct process parameters
  - correct equipment
- taking corrective action
- adjusting solutions/times/reprocessing or additional processing
- carrying out appropriate mechanical/chemical pre-treatment
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- performing calculations using formulae

#### Required knowledge

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms knowledge of:

- effects of plating process on different materials
- basic principles of chemistry, electro chemistry and metallurgy related to the process including:
  - importance of maintaining satisfactory electrical contact
  - methods for detecting unsatisfactory contact
  - effects of build-up on cathode contacts
  - properties of different base materials
  - different pre-treatment processes and their application
  - process parameters and their relation to each other
  - differences between chromate conversion coatings
- types of defects, their causes and related corrective actions
- mechanical/chemical pre-treatment processes
- the purpose and application of simple tests including pH and concentration
- operating parameters of solutions including temperature, agitation rate and similar parameters
- acceptable appearances for each stage of operation and common abnormalities
- application of different equipment to the type of work processed and correct operation and cleaning requirements (e.g. of cleaning filters)
- solutions, solution compositions and operating ranges for processes relative to protective finishes, including cleaning/pre-treatment, electroplating and post treatment
- procedures for testing plate thickness
- safe working procedures for handling chemicals relative to protective finishes and for safely adding to baths
- procedures for measuring out materials eg use of scales, volumetric measurement devices
- level of impurities and permissible limits, effects of impurities and purification procedures for protective finish solutions
- different anode arrangements including use of baskets and bags, conforming anodes
- correct operation of anodes and appropriate remedial action
- effect of maintenance schedules on plant performance and performance requirements and basic maintenance checks for rectifier, bus bars, agitation, heating/cooling, extraction and tank linings etc.
- use and application of personal protective equipment
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to electroplate protective finishes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with electroplating protective finishes or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Treatment processes</b>	Zinc, zinc alloys and tin
<b>Process parameters</b>	Dwell time, current density, current temperature
<b>Equipment</b>	Wire racks, handling equipment, barrels, jigs, shields, robbers, etc.
<b>Operating process parameters</b>	Calculation and setting of treatment times and currents, bath pH, temperatures and densities, solution levels and compositions, purification procedures
<b>Maintain solutions</b>	Typical tests for pH and concentration, calculation of adjustments to relevant solutions
<b>Adjustment</b>	Strength of solutions, temperature range
<b>Anodes</b>	Soluble, insoluble auxiliary anodes, etc.
<b>Maintain equipment</b>	Anode condition, electrical contacts etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Surface finishing
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## MEM08020B Electroplate decorative finishes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying decorative finishes to a range of ferrous and non-ferrous materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to electroplating decorative finishes to household fittings, hardware, artefacts and accessories. Processing may apply to manual, semi or fully automatic still or barrel plating environments and may include volume production and 'one-off' components.</p> <p>Use of plating techniques, solutions and compositions for decorative finishes, recognition and assessment of impurities and imperfections and associated corrective actions are integral to all applications.</p> <p>Work is undertaken autonomously or in a team environment using predetermined standards of quality, safety.</p> <p>All work is undertaken to accepted industry OH&amp;S practices and to legislative requirements where applicable.</p> <p>For pre-treatment operations Unit MEM08011B (Prepare surfaces using solvents and/or mechanical means) and/or Unit MEM08012B (Prepare surfaces by abrasive blasting [basic]) should be selected. For basic inspection of completed or partly completed products produced by others Unit MEM15004B (Perform inspection) should be selected. Where dogging/lifting is undertaken, the appropriate materials handling units should be selected. For construction of anodes, shields/robbars etc., the appropriate fabrication units should be selected.</p> <p>For straightforward operation/monitoring of electroplating processes, Unit MEM08003C (Perform electroplating operations) should be selected.</p>
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	<b>Band: A</b> <b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07001B	Perform operational maintenance of machines/equipment
	MEM08001B	Wire, jig and barrel load/unload work
	MEM08003C	Perform electroplating operations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select treatments and processes/equipment for producing decorative finishes	1.1.Appropriate treatment processes are selected according to base metal type, surface condition and relevant job specifications. 1.2.Mass treatment processes are selected and carried out, where applicable. 1.3.Pre-plating treatments are identified. 1.4.Process parameters are selected to achieve required coating. 1.5.Appropriate equipment is selected.
2. Monitor and control decorative finish processes and operating conditions	2.1.Operating parameters are set to produce required decorative finish/specifications. 2.2.Plate appearance and final finish are monitored and confirmed and abnormalities are identified. 2.3.Corrective actions are taken to rectify non-conforming conditions. 2.4.Pre-treatment processes are carried out, where applicable. 2.5.Racks, jigs and barrels are checked for correct loading.
3. Maintain solutions for decorative finishes	3.1.Solution compositions are checked and confirmed to specification/operating range. 3.2.Adjustment requirements/additions are identified. 3.3.Additions are made to adjust solution composition to correct operating range. 3.4.Purification procedures are carried out as appropriate. 3.5.Anodes are maintained to ensure correct operation.
4. Maintain equipment for decorative finishes	4.1.Performance of ancillary equipment is checked and remedial actions are taken as necessary. 4.2.Electrical contacts are maintained. 4.3.Process transfer equipment is maintained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- maintaining equipment
- maintaining satisfactory electrical contact
- planning and sequencing work operation
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- specific pre-treatment processes - common base metals/soils, chemical/mechanical
- effect of decorative treatment on different metals
- functions of strikes/activation treatment
- process parameters, including current computations
- effects of parameters on performance
- post treatment processes
- Australian standards
- application of different equipment to the type of work processed
- acceptable appearances including final specification/quality
- abnormalities
- requirements for post treatments
- types of defects
- factors affecting plate distribution
- purpose and application of simple control tests
- calculations for additions/adjustments to solutions
- effects of adding chemicals too quickly
- purification procedures/treatments
- operation of anodes, arrangements, remedial action
- effects of build-up on cathode contacts, damage to rack coatings
- any applicable industry standards, national/Australian standards, NOHSC guides, state/territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to electroplate decorative finishes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with electroplating decorative finishes or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not

**EVIDENCE GUIDE**

	require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Decorative finishes</b>	Decorative finishes would include nickel, chrome, copper, silver, gold and rhodium
<b>Treatment processes</b>	Pre-treatment, electroplating, electroforming, electroless plating, electrophoretic coating, post treatment plating out, carbon and chemical treatments for decorative finish solutions
<b>Pre-plating treatments</b>	Pre-treatments for common base metals and soils can be given, including degreasing, soak/cleaning, electrolytic cleaning, activating dips
<b>Equipment</b>	Wire racks, handling equipment, barrels, jigs, shields, robbers, etc. Performance requirements and basic maintenance checks for rectifier, bus bars, agitation, heating/cooling, extraction and tank linings
<b>Operating parameters</b>	Calculation and setting of treatment times and currents, bath pH, temperatures and densities, agitation rate, process (deposition) time, solution

<b>RANGE STATEMENT</b>	
	levels and compositions, purification procedures
<b>Abnormalities</b>	Abnormalities associated with decorative plating and their causes, including poor/uneven brightness/texture, inadequate levelling, roughness, pitting, poor adhesion, blistering, burning, poor plate coverage (particularly chromium), incorrect colour (particularly flash brass, gold)
<b>Maintain solutions</b>	Typical tests for pH density and titration, calculation of adjustments to relevant solutions
<b>Solution compositions</b>	Cleaning, pickling, electroplating, chromate solutions and acid dips
<b>Anodes</b>	Soluble, insoluble auxiliary anodes, etc.
<b>Maintain equipment</b>	Anode condition, electrical contacts etc.
<b>Process transfer equipment</b>	Baskets, spreader bars, racks, hooks etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



## Competency field

Competency field	Surface finishing
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## MEM09002B Interpret technical drawing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers interpreting technical drawing applying to any of the full range of engineering disciplines.
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### Application of the Unit

<b>Application of the unit</b>	<p>Technical drawings may utilise perspective, exploded views or hidden view techniques. Drawings are provided to Australian Standard 1100 and/or Australian Standard 1102 and their equivalents from the full range of engineering disciplines.</p> <p>Standard symbols to Australian Standard 1100 and/or Australian Standard 1102 or equivalent are recognised in field of employment. Technical drawings may include symbol glossaries.</p> <p>Where any drawing, sketch, chart, diagram is only used as the technique for communication, then this unit does not apply: see Unit MEM12023A (perform engineering measurements) or Unit MEM16006A (Organise and communicate information).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select correct technical drawing	1.1.Drawing is checked and validated against job requirements or equipment. 1.2.Drawing version is checked and validated.
2. Interpret technical drawing	2.1.Components, assemblies or objects are recognised as required. 2.2.Dimensions are identified as appropriate to field of employment. 2.3.Instructions are identified and followed as required. 2.4.Material requirements are identified as required. 2.5.Symbols are recognised in the drawing as appropriate.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- checking the drawing against job requirements/related equipment in accordance with standard operating procedures
- confirming the drawing version as being current in accordance with standard operating procedures
- where appropriate, obtaining the current version of the drawing in accordance with standard operating procedures
- reading, interpreting information on the drawing, written job instructions, specifications, standard operating procedures, charts, lists and other applicable reference documents
- checking and clarifying task related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- application of AS1100.101 in accordance with standard operating procedures
- relationship between the views contained in the drawing
- objects represented in the drawing
- units of measurement used in the preparation of the drawing
- dimensions of the key features of the objects depicted in the drawing
- understanding of the instructions contained in the drawing
- the actions to be undertaken in response to those instructions
- the materials from which the object(s) are made
- any symbols used in the drawing as described in range statement
- hazard and control measures associated with interpreting technical drawings, including housekeeping
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret technical drawings as described.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with interpreting technical drawings or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Interpret technical drawing

AS1100.101 is an extensive work and the candidate is not required to have complete familiarity with all its contents, the application of AS1100 would usually be in line with standard operating procedures; interpretation may require guidance particularly in respect to any geometric tolerancing

## Unit Sector(s)

### Unit sector

## Co-requisite units

Co-requisite units	

## Competency field

Competency field	Drawing, drafting and design
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## MEM09003B Prepare basic engineering drawing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying the drawing requirements, preparing or making changes to engineering drawings, preparing an engineering parts list and issuing the drawings
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the fields of mechanical, electrical/electronic, fabrication, and fluid power. Specifications may be obtained from design information, customer requirements, sketches and preliminary layouts. Manual drafting and drawing equipment is used, or where a Computer Aided Design (CAD) system is used other units should also be considered. This unit applies to any of the full range of engineering disciplines.</p> <p>Where a more extensive Computer Aided Drafting System is used for design, then Unit MEM09009C (Create 2D drawings using computer aided design system), should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify drawing requirements	<p>1.1. Requirements and purpose of drawing are determined from customer and/or work specification and associated documents.</p> <p>1.2. All data necessary to produce the drawing is identified and collected.</p> <p>1.3. Drawing requirements are confirmed with relevant personnel and timeframes for completion are established.</p>
2. Prepare or make changes to engineering drawing	<p>2.1. Drafting equipment is selected appropriate to the drawing method chosen.</p> <p>2.2. Drafting principles are applied to produce a drawing that is consistent with standard operating procedures</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>within the enterprise.</p> <p>2.3.All work is undertaken safely and to prescribed procedure.</p> <p>2.4.Completed drawing is approved in accordance with standard operating procedures.</p>
3. Prepare engineering parts list	3.1.Components parts are identified and organised by component type and/or in accordance with organisation/customer requirements.
4. Issue drawing	<p>4.1.Drawings and or parts lists records are completed in accordance with standard operating procedures.</p> <p>4.2.Approved drawings and or parts lists are copied and issued to relevant personnel in accordance with standard operating procedures.</p> <p>4.3.Approved drawings and or parts lists are stored and catalogued in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant job requirements, data/information and specifications necessary to produce the drawing in accordance with workplace procedures
- using drafting equipment appropriate to the drawing method chosen
- producing/changing the drawing to conform with the relevant standard
- undertaking all work safely and in accordance with workplace procedures
- checking the completed drawing in accordance with standard operating procedures
- producing the component parts list with part name, description of part, material specification or part number, quantities and all other details specified by the customer and/or organisational procedures
- recording completed drawings and or parts lists in accordance with standard operating procedures
- where appropriate, copying and issuing approved drawings and or parts lists in accordance with standard operating procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- handling and storing the approved drawings and or parts lists in accordance with standard operating procedures
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- requirements and purpose of the drawing to be produced
- requirements and purpose of the engineering parts list
- sources of relevant data/ information
- timeframe for completion of the drawing(s)
- person(s) who can confirm drawing requirements
- method of drawing preparation
- the reasons for selecting the chosen drawing method
- procedures for producing an initial drawing
- procedures for changing an existing drawing
- drafting principles to be applied to the production/changing of a drawing
- standards to which the drawing is to be produced
- procedures for checking drawings
- the persons responsible for checking and approving drawings
- consequences of inappropriate/incomplete components parts lists
- procedures and reasons for recording completed drawings and or parts lists
- procedures for copying approved drawings and or parts lists
- procedures for issuing approved drawings and or parts lists
- the personnel to whom copies of approved drawings and or parts lists can be issued
- procedures for filing approved drawings and or parts lists
- procedures for safe handling and storage of drawings and or parts lists
- consequences of inappropriate handling and storage of approved drawings and or parts lists
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare basic engineering drawings. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing basic engineering drawing or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Relevant personnel**

Technical personnel, supervisors, manufacturers, suppliers, contractors, customers

**Drafting equipment**

Drafting and drawing equipment includes the use of Computer Aided Drafting systems

**Drafting principles**

Drawings are prepared in accordance with Australian Standard 1100.101, or equivalent, as required

Interpretation of AS1100.101 or other problems are resolved in consultation with a supervisor

**Records**

Drawing records may include cataloguing, issuing security classifications, filing, preparing distribution lists

**Issued**

In hard copy, photographic, slide or transparency form including presentation as a single drawing and/or with other drawings, support documentation as a package

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09004B Perform electrical/electronic detail drafting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing electrical/electronic drawings under supervision.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of drawings under supervision, in accordance with instructions and specifications to Australian Standard 1102 or equivalent using predetermined design specifications.</p> <p>This unit applies to all electrical/electronic areas.</p> <p>Manual drafting or drawing equipment is used or where a CAD system is used, Unit MEM09009C (Create 2D drawings using computer aided design system) and/or Unit MEM09010C (Create 3D models using computer aided design system) should also be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM09003B	Prepare basic engineering drawing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare/make changes to electrical/electronic schematics and drawings	1.1.Schematic is drawn to indicate the relative positioning of electrical/electronic components. 1.2.Electrical/electronic drawings are produced to include all relevant specifications. 1.3.Schematic/drawing is completed to Australian Standard 1102 or equivalent.
2. Determine component and/or material requirement	2.1.Components and/or materials are selected from supplier/manufacturers' catalogues using design specifications.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- drawing electrical/electronic schematics correctly and indicating the relative position of the components
- producing electrical/electronic drawings with all relevant specifications
- producing electrical/electronic schematics/drawings in conformance with AS1102 or equivalent
- obtaining the circuit/component specifications
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable documents
- planning and sequencing operations
- checking and clarifying task related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- relative position of electrical/electronic components
- symbols used in electrical/electronic schematics and drawings
- specifications of all components
- circuit specifications
- requirements of AS1102 or equivalent with respect to electrical/electronic schematics/drawings
- design specifications of the circuit/components
- appropriate components and materials from supplier/manufacturers' catalogues
- reasons for selecting the chosen components and/or materials
- hazards and control measure associated with performing electrical/electronic detail drafting, including housekeeping
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform electrical/electronic detail drafting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing electrical/electronic detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Drawings**

Include plans, schematics, layouts, circuit diagrams and charts

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09005B Perform basic engineering detail drafting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing drawings to Australian Standard 1100 or equivalent where the critical dimensions and associated tolerances and design specifications are predetermined.
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### Application of the Unit

<b>Application of the unit</b>	<p>Manual drafting or drawing equipment is used or where a CAD (Computer Aided Design) system is used, Unit MEM09009C (Create 2D drawings using computer aided design system) and/or Unit MEM09010C (Create 3D models using computer aided design system) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM09003B	Prepare basic engineering drawing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare assembly, layout and detail drafting	<p>1.1. Drawings are prepared in plane orthogonal, isometric projection or equivalent including auxiliary views and sections to Australian Standard 1100.</p> <p>1.2. Layout, assembly and component drawings are prepared from specification.</p> <p>1.3. Drawings are dimensioned and labelled using supplied tolerances in accordance with Australian Standard 1100.</p> <p>1.4. Drawings are produced to specification in accordance with standard operating procedures.</p> <p>1.5. Standard symbols to Australian Standard 1100 or equivalent are used to specify requirements.</p>
2. Determine component and/or material requirement	2.1. Components and/or materials are selected from supplier/manufacturers' catalogues using design specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing drawings using appropriate projections and views in accordance with AS1100 or equivalent, see above note in the range statement
- producing layout, assembly and component drawings in conformance with specification
- inserting all relevant dimensions, tolerances and instructions in the drawing
- producing drawings to specification
- appropriately using standard symbols in accordance with AS1100 or equivalent in the drawings produced
- obtaining component specifications in accordance with work place procedures
- reading, interpreting and following information written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- appropriate projection for the drawing purpose
- reasons for selecting the chosen projection
- reasons for including auxiliary views in drawings
- requirements of AS1100 or equivalent with respect to dimensions, tolerances and labels
- procedures for producing component, layout and/or assembly drawings
- drawing specifications
- common symbols used in drawings to AS1100 or equivalent
- design specifications of the component
- appropriate components and materials from supplier/manufacturers' catalogues
- reasons for selecting the chosen components and/or materials
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform basic engineering detail drafting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with basic engineering detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Australian Standard 1100**

AS1100.100 is an extensive work and its application would usually be in line with standard operating procedures; interpretation would be under guidance particularly in respect to any geometric tolerancing

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09006B Perform advanced engineering detail drafting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing assembly, layout and detail drawings to Australian Standard 1100 or equivalent.
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### Application of the Unit

<b>Application of the unit</b>	<p>Skills covered by this unit are applied individually or in a team environment where comprehensive responsibility for the production of the drawing is exercised, and critical dimensions and associated tolerances are determined where required.</p> <p>Manual drafting and drawing equipment is used or where a CAD (Computer Aided Design) system is used, Unit MEM09009C (Create 2D drawings using computer aided design system) and/or Unit MEM09010C (Create 3D models using computer aided design system) should also be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM09003B	Prepare basic engineering drawing
	MEM09005B	Basic engineering detail drafting

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare assembly, layout and detail drawing	<p>1.1. Specification requirements are determined.</p> <p>1.2. Engineering calculations are undertaken to determine all dimensions including limits and fits, surface texture, datum references and geometric tolerances where appropriate to ensure functional operation and suitability.</p> <p>1.3. All drawings are produced to Australian Standard 1100 or equivalent.</p>
2. Interpret specifications and select material, components and/or	<p>2.1. Components, material and/or assemblies are selected from data sheets or manufacturers' catalogues to meet specifications.</p>

ELEMENT	PERFORMANCE CRITERIA
assemblies	
3. Check drawings	<p>3.1. Drawings are checked to ensure compliance with specifications.</p> <p>3.2. Drawings are checked to ensure that assembly/fabrication is possible.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant work instructions and requirements
- producing all drawings in accordance with AS1100 or equivalent
- obtaining all relevant data sheets, catalogues, etc.
- checking drawings for conformance to specification
- checking drawings to ensure that assembly/fabrication is possible
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- specifications and/or requirements of the component, assembly or layout to be drawn
- functional operation of the component/assembly to be drawn
- surfaces which are to be in contact or separated
- appropriate type of fit for contacting surfaces
- reasons for selecting the chosen type of fit
- effect of surface finish on the performance/operation of surfaces
- appropriate datum points

**REQUIRED SKILLS AND KNOWLEDGE**

- all appropriate lineal, diametric and geometric tolerances
- procedures for determining tolerances
- requirements of AS1100 or equivalent for the drawing(s) to be produced
- specifications of the components, materials and/or assemblies
- appropriate components and materials from supplier/manufacturers' catalogues
- reasons for selecting the chosen components and/or materials
- procedures for checking and approving drawings
- reasons for checking the drawings to ensure that manufacturing/assembly is possible, efficient and cost effective
- drawing specifications
- methods of manufacture/assembly/fabrication from the drawing(s)
- unnecessary or inappropriate tolerances
- hazards and control measures associated with performing advanced engineering detail drafting, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform advanced engineering detail drafting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

**EVIDENCE GUIDE**

	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced engineering detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Australian Standard 1100 or equivalent**

Complete familiarity with AS 1100.101 or similar and its application is required in the respective field

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Drawing, drafting and design
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## MEM09007B Perform advanced mechanical detail drafting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing mechanical assembly, mechanical layout and detail drawings to AS1100 or equivalent.
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### Application of the Unit

<b>Application of the unit</b>	<p>Skills covered by this unit are applied individually or in a team environment where comprehensive responsibility for the production of the drawing is exercised, and critical dimensions and associated tolerances are determined where required.</p> <p>Manual drafting and drawing equipment is used or where a CAD system is used, Unit MEM09009C (Create 2D drawings using computer aided design system) and/or Unit MEM09010C (Create 3D models using computer aided design system) should also be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM09003B	Prepare basic engineering drawing
	MEM09005B	Perform basic engineering detail drafting
	MEM09006B	Perform advanced engineering detail drafting

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare mechanical assembly, layout drawings	<p>1.1.All drawings are produced to Australian Standard 1100 or equivalent.</p> <p>1.2.Dimensions of various components are determined and inserted and appropriate symbols for limits and fits, surface texture and geometric tolerances are included.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- producing all drawings in accordance with AS1100 or equivalent, see above notes in range statement
- representing the function of each component within the assembly/layout in accordance with design specifications/operational requirements
- manufacturing, fabricating and assembling all components in accordance with the specifications contained in the drawings
- where appropriate, orientating all components correctly to surrounding structures and services
- where appropriate, modifying drawings to ensure conformance to specification AS1100 or equivalent, and/or changes to production, assembly and fabrication requirements and/or the availability of standard hardware items etc.
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- function of each component within the assembly/layout
- manufacturing, fabrication and assembly procedures to be used in producing the components/assemblies
- reason for ensuring that all components are correctly orientated to existing or proposed structures and services
- reasons for updating/modifying drawings to incorporate changes to specifications, production, assembly and fabrication methods and availability of standard hardware items, etc.
- hazards and control measures associated with performing advanced mechanical detail drafting, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform advanced mechanical detail drafting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced mechanical detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

<b>EVIDENCE GUIDE</b>	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Australian Standard 1100 or equivalent</b>	Complete familiarity with AS 1100.101 or similar and its application is required in the respective field

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09008B Perform advanced structural detail drafting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing fabrication/structural assembly, fabrication/structural layout drawings to AS 1100 or equivalent.
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### Application of the Unit

<b>Application of the unit</b>	<p>Skills covered by this unit are applied individually or in a team environment where comprehensive responsibility for the production of the drawing is exercised, and critical dimensions and associated tolerances are determined where required.</p> <p>Manual drafting and drawing equipment is used or where a CAD system is used, Unit MEM09009C (Create 2D drawing using computer aided design system) and/or Unit MEM09010C (Create 3D models using computer aided design system) should also be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare fabrication/structural assembly, layout drawing	<p>1.1.All drawings are produced to Australian Standard 1100 or equivalent.</p> <p>1.2.Dimensions of various components are determined and inserted and appropriate symbols for limits and fits, surface texture and geometric tolerances are included.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE



**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- producing all drawings in accordance with AS1100 or equivalent
- representing the function of each component within the assembly/layout in accordance with design specifications/operational requirements
- manufacturing, fabricating and assembling all components in accordance with the specifications contained in the drawings
- where appropriate, correctly orientating all components to surrounding structures and services
- where appropriate, modifying drawings to ensure conformance to specification AS1100 or equivalent, and/or changes to production, assembly and fabrication requirements and/or the availability of standard hardware items etc.
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- function of each component within the assembly/layout
- manufacturing, fabrication and assembly procedures to be used in producing the components/assemblies
- reason for ensuring that all components are correctly orientated to existing or proposed structures and services
- reasons for updating/modifying drawings to incorporate changes to specifications, production, assembly and fabrication methods and availability of standard hardware items, etc.
- hazards and control measures associated with performing advanced structural detail drafting, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform advanced structural detail drafting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced structural detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Australian Standard 1100 or equivalent</b>	Complete familiarity with AS 1100.101 or similar and its application is required in the respective field
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09009C Create 2D drawings using computer aided design system

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing the CAD environment, creating 2D drawings, and producing output including linked bills of materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of 2D drawings using a CAD system, linked bills of material, file management and associated customisation of installed software including the use of macros, menus and default settings; file formats may include IGES, DXF, HPGL.</p> <p>The unit applies to the fields of mechanical, electrical/electronic, fabrication, and fluid power. 2D drawings may be produced from 3D models created using computer aided design system.</p> <p>This unit covers CAD skills only. Where detail drafting skills are required, the following units should be considered: Unit MEM09004B (Perform electrical/electronic detail drafting), Unit MEM09005B (Perform basic engineering detail drafting), Unit MEM09006B (Perform advanced engineering detail drafting).</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM16008A	Interact with computing technology

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare CAD environment	<ul style="list-style-type: none"><li>1.1. System variables are customised to suit standard operating procedures.</li><li>1.2. Menus are customised to suit standard operating procedures.</li><li>1.3. Drawing defaults are customised to standard operating procedures.</li><li>1.4. Macros are developed to standard operating procedures.</li></ul>

ELEMENT	PERFORMANCE CRITERIA
2. Create 2D drawings	<p>2.1. Drawings are created using the full capability of the available software system.</p> <p>2.2. Drawing entities are linked to database attributes to suit job requirements.</p> <p>2.3. Detailed views are created using various scales to meet job requirements.</p>
3. Produce output	<p>3.1. Files are saved in various formats to standard operating procedures.</p> <p>3.2. Linked entities are listed in a bill of materials format to meet job requirements.</p> <p>3.3. Supplementary data is extracted from drawing to meet job requirements and may include area, lengths, angles and perimeters.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant manuals, instructions and operation procedures for the CAD software and hardware being used
- where appropriate, customising the relevant system variables to suit the applicable drafting standards/procedures
- where appropriate, customising menus to suit the applicable drafting standards/procedures
- where appropriate, customising the system defaults to suit the applicable drafting standards/procedures
- where appropriate, developing macros
- creating drawings using the appropriate drawing features of the software system
- where appropriate, linking drawing entities to database attributes
- producing detailed views of the object being drawn
- printing drawing files at the appropriate scale
- saving drawing files in the appropriate format
- producing bills of material from the drawing files/database
- extracting supplementary data from the drawing file to meet job requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- CAD software system
- system variables that can be customised
- procedures for customising identified system variables
- reasons for customising the system variables
- applicable drafting standards/procedures
- procedures for customising menus
- reasons for customising menus
- procedures for customising system defaults
- reasons for customising system defaults
- procedures for developing macros
- reasons for developing macros
- drawing features of the CAD software system
- reasons for using specialised software features
- procedures for linking drawing entities to database attributes
- appropriate drawing scales
- procedures for printing drawing files
- procedures for creating additional views of the object being drawn
- procedures for saving drawing files
- various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures to produce bills of material
- procedures to extract data with respect to drawn shapes/features
- properties of shapes/sections/ features that can be extracted from the drawing file
- hazards and control measures associated with using computer aided design system, including housekeeping
- safe work practices and procedures



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to create 2D drawings using computer aided design system. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 2D drawings using computer aided design system or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Drawing</b>	Include plans, diagrams, charts, electrical/electronic circuits
<b>Entities</b>	Mean any single item created on the screen and includes for example lines, arcs, circles, text, hatch and dimensions
<b>Attributes</b>	Mean properties associated with an entity and includes for example layer or level, line type, line width, colour and text

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Drawing, drafting and design
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## MEM09010C Create 3D models using computer aided design system

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing the 3D CAD environment, creating and modifying 3D models, and producing output from the 3D model.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of 3D models utilising computer equipment. Operations at this level include, but are not limited to, the creation and manipulation of entities such as arcs and lines and primitives such as spheres, cones, cylinders and boxes using industrial software. The unit applies to the fields of mechanical, electrical/electronic, fabrication, and fluid power.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

<b>Prerequisite units</b>		
	MEM09009C	Create 2D drawings using computer aided design system
	MEM16008A	Interact with computing technology

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare 3D environment	1.1.Coordinate system is established to job requirement. 1.2.Orientation is established to job requirement. 1.3.Views are established to job requirement.
2. Create and modify 3D model	2.1.Entities are created in 3D space to job requirement. 2.2.Entities are manipulated in 3D space to job requirement. 2.3.Surfaces are created in 3D space to job requirement including ruled and revolved. 2.4.Existing 3D model is modified to job requirement.
3. Produce output from 3D model	3.1.File is saved in various formats for retrieval as per standard operating procedures. 3.2.Physical properties are extracted to job requirement

ELEMENT	PERFORMANCE CRITERIA
	including volume, mass and centre of gravity.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant job instructions, specifications, etc.
- creating the appropriate entities in 3D space
- manipulating the entities in 3D space
- creating ruled and revolved surfaces in 3D space
- modifying, where appropriate, existing 3D models
- saving drawing files in the appropriate format
- extracting the physical properties of shapes created in 3D space from the drawing file to meet job requirements
- reading, interpreting and following information on written job instructions, specification, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- purpose for which the 3D model is to be developed
- appropriate coordinate system for the job
- reasons for selecting the chosen coordinate system
- orientation of the model with respect to the coordinate system
- number of views required to establish the model
- procedures for creating entities in 3D space
- the entities that can be created/manipulated in 3D space
- procedures for manipulating entities in 3D space
- procedures for creating ruled and revolved surfaces in 3D space
- applications of ruled and revolved surfaces

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for modifying existing 3D models
- procedures for saving drawing files
- the various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures for extracting data with respect to the physical properties of shapes created in 3D space
- the physical properties of shapes created in 3D space that can be extracted from the drawing file
- hazard and control measures associated with using computer aided design system, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to create 3D models using computer aided design systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 3D models using computer aided design systems or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	



**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Drawing, drafting and design
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## MEM09011B Apply basic engineering design concepts

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying in situ design skills by personnel who are then responsible for the manufacture of the design outcome either individually or as part of a team.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit includes the determination of requirements such as location, assembly or other parts of the manufacturing or engineering process and where the designer must consider the impact of the design on other equipment, process or personnel, for example safety aspects of the design.</p> <p>Design tasks undertaken include the application of design concepts to, for example, the fabrication and modification of structures, plant and equipment, and design of tooling and gauges, production control systems, fluid power layouts, electrical circuits etc.</p> <p>The unit applies to the fields of mechanical, production, electrical/electronic, fabrication, and fluid power.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine design requirements	<p>1.1.Design requirement is established from job sheets, instructions or in consultation with appropriate people.</p> <p>1.2.Design concepts are established and may include consideration of process, material, quantity, cost and outcome.</p> <p>1.3.Where appropriate, codes, regulations and technical documentation are consulted to establish design limitations in accordance with standard operating procedures.</p> <p>1.4.Sources of expert assistance are identified and used as required.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Create design	<p>2.1.Design meets end use requirement.</p> <p>2.2.Design meets all legislative and regulatory requirements.</p> <p>2.3.Design concept is verified in accordance with standard operating procedures.</p> <p>2.4.Design outcome is produced as per job requirements and may include sketch, drawing, prototype, document, model or finished product.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant drawings, job sheets, instructions and specifications
- consulting, where appropriate, relevant personnel as to the design requirements
- inspecting, where appropriate, the object, plant or equipment to which engineering design concepts are to be applied
- determining, where appropriate, design limitations imposed by relevant codes, standards and regulations
- where appropriate, seeking assistance from relevant sources
- verifying the design concept.
- presenting the design object in a form appropriate to the job requirements
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task related information
- planning and sequencing operations
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- design requirements

## REQUIRED SKILLS AND KNOWLEDGE

- functional requirements of the design
- the material(s) appropriate to the environment in which the object(s) to be designed is to operate
- processes to be used in the manufacture of the object(s)
- where appropriate, the costs associated with the manufacture of the object(s)
- reasons for selecting the chosen design concept
- all relevant codes, standards and regulations applying to the object to be designed
- the impact of the applicable codes, standards and regulations on the design requirements of the object
- sources of expert assistance in the design process
- the end use requirements of the design
- checks to ensure the design complies with the relevant codes, standards, legislative and regulatory requirements
- the procedures for verifying design concepts
- the means by which the design concept is to be presented
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply basic engineering design concepts. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic engineering design concepts or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

RANGE STATEMENT	

### Unit Sector(s)

Unit sector	
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### Co-requisite units

Co-requisite units		

### Competency field

Competency field	Drawing, drafting and design
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## MEM09021B Interpret and produce curved 3-dimensional shapes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing and interpreting lines plan drawings manually or using CAD equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to drawing and lofting principles relevant to procedures used to produce lines plan drawings and loftings. Common applications of this unit are in marine vessel construction.</p> <p>In a marine setting, tasks may be related to a variety of hull designs, section development such as curved and raking transom, conical development and camber development methods. General arrangement plans may also be addressed to provide a greater drawing diversity.</p> <p>All drawings/data should comply with industry requirements.</p> <p>Straightforward take-offs from lofted drawings is covered by MEM12007D (Mark off/out structural fabrications and shapes). Also, where transfer of lines to lofting floor or other surface is carried out, Unit MEM12007D (Mark off/out structural fabrications and shapes) should be selected in addition to this unit.</p> <p>Where a CAD system is used for basic drawing, Unit MEM09003B (Prepare basic engineering drawing) should also be selected. Where more extensive CAD system is used for design then Unit MEM09009C (Create 2D drawings using computer aided design system) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify drawing/lofting requirements	1.1.Requirements of lines drawing/lofting are determined. 1.2.Data necessary to produce drawing/lofting is identified.

ELEMENT	PERFORMANCE CRITERIA
2. Determine drawing/lofting procedure and equipment	<p>2.1.Lines drawing/lofting procedures are outlined and understood.</p> <p>2.2.Appropriate drawing equipment/accessories are outlined.</p>
3. Apply drawing/lofting procedures	<p>3.1.Appropriate drawing equipment/accessories are set up to suit requirements.</p> <p>3.2.Drafting/lofting procedures to suit specified drawing are applied.</p> <p>3.3.Where applicable, any alterations to offset measurements are recorded.</p> <p>3.4.Drawings/loftings are consistent with operation procedures and industry requirements.</p>
4. Submit lines plan drawings	<p>4.1.Completed drawings are submitted in accordance with industry standards.</p> <p>4.2.Where applicable, altered offset measurements and relevant information related to drawing are supplied.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, client briefings, standard operating procedures, charts, lists, drawings and other applicable reference documents
- analysing and organising information and planning and sequencing operations
- checking and clarifying task-related information
- checking for conformance to specifications
- performing computations including geometric and numerical calculations/formulae within the scope of this unit
- measuring
- drawing and sketching skills

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- hazards and control measures associated with interpreting and producing curved 3-dimensional shapes, including housekeeping
- safe work practices and procedures
- vessel design characteristics, including performance, stability, construction methods, etc.
- spatial concepts

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to interpret and produce curved 3-dimensional shapes.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with interpreting and producing curved 3-dimensional shapes or other units requiring the exercise of the skills

<b>EVIDENCE GUIDE</b>	
	and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Requirements</b>	Client brief, industry standards and survey specifications, where applicable
<b>Submitted</b>	Submitted to client, supervisor, boat builder/ship builder, surveying authority, etc.
<b>Industry standards</b>	Those standards accepted by industry (and surveying authority, where appropriate) in terms of accuracy, design, layout, tabulation of offsets, material specification, construction specifications and quality of presentation of drawings

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Drawing, drafting and design
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## MEM09022A Create 2D code files using computer aided manufacturing system

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing 2D CAM code files, managing files, managing tools and associated customisation of installed software including the use of macros, menus and default settings.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit typically applies in a manufacturing setting where components are machined or processed within a CAM environment. Code files would be produced from existing CAD models.</p> <p>If 2D CAD models are produced, Unit MEM09009C (Create 2D drawings using computer aided design system) should also be selected. Where components are machined following development of code files, appropriate CNC machining units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM16008A	Interact with computing technology
	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for computer aided manufacture	1.1. System variables are customised to suit standard operating procedures. 1.2. User interface is customised to suit standard operating procedures. 1.3. Software defaults are customised to suit standard operating procedures. 1.4. Manufacturing data is developed to standard operating procedures.
2. Manipulate 2D models	2.1. Models are imported using various file formats. 2.2. Models are oriented and manipulated using the full

ELEMENT	PERFORMANCE CRITERIA
	<p>capability of the software system.</p> <p>2.3. Model entities are linked to database attributes to suit job requirements.</p> <p>2.4. Manufacturing data is applied to detailed models to suit various applications and job requirements</p>
3. Produce output from 2D model	<p>3.1. Files are saved in various formats to standard operating procedures.</p> <p>3.2. CAM model is verified for logical sequencing and correct manufacturing procedures.</p> <p>3.3. Code is produced from the 2D CAM model.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting relevant manuals, instructions and operating procedures
- customising relevant system variables
- customising menus and system defaults
- developing macros
- manipulating models
- linking model entities to database attributes
- creating manufacturing data for various operations and processes
- importing CAD files
- saving and managing CAM files

#### Required knowledge

Look for evidence that confirms knowledge of:

- model features of the CAM software system
- operation of the CAM software system
- the system variables and procedures for customising
- procedures for customising user interface
- procedures for customising system defaults
- procedures for developing macros



**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for linking model entities to database attributes
- CAD file conversion
- CAM file formats
- procedures for saving and managing CAM files

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to create 2D code files using a computer aided manufacture system. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 2D code files, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Entities</b>	Any single item created on the screen and includes, for example, lines, arcs, circles and text
<b>Attribute</b>	Properties associated with an entity that include, for example, layer or level, line type, colour and text

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Drawing, drafting and design
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## MEM09023A Create 3D code files using computer aided manufacturing system

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing 3D CAM code files, managing files, managing tools and associated customisation of installed software including the use of macros, menus and default settings
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit typically applies in a manufacturing setting where components are machined or processed within a CAM environment. Code files would be produced from existing CAD models or from data collected by sample measurement.</p> <p>If 2D drawings or 3D CAD models are produced, Unit MEM09009C (Create 2D drawings using computer aided design system) and Unit MEM09010C (Create 3D models using computer aided design system) should also be selected as required.</p> <p>Where components are machined following development of code files, appropriate CNC machining units should also be selected.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM09022A	Create 2D code files using computer aided manufacturing system
	MEM12023A	Perform engineering measurements
	MEM16008A	Interact with computing technology

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare 3D environment	1.1.Coordinate system is established to job requirements. 1.2.Orientation is established to job requirement. 1.3.Views are established to job requirement.
2. Manipulate 3D models	2.1.Models are imported using various file formats. 2.2.Existing 3D models are oriented and manipulated to

ELEMENT	PERFORMANCE CRITERIA
	<p>job requirements.</p> <p>2.3. Model entities are linked to database attributes to suit job requirements.</p> <p>2.4. Manufacturing data is developed from the 3D CAM model.</p>
3. Produce output and manage 3D code files	<p>3.1. Files are saved in various formats for retrieval according to standard operating procedures.</p> <p>3.2. CAM model is verified for logical sequencing and correct manufacturing procedures.</p> <p>3.3. Code is produced from the 3D CAM model.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting job instructions, specifications in accordance with workplace procedures
- manipulating entities in 3D space
- producing code files
- creating manufacturing data for various operations and processes
- importing CAD files
- saving and managing CAM files

#### Required knowledge

Look for evidence that confirms knowledge of:

- coordinate systems
- orientation of the model with respect to the coordinate system
- procedures for customising system defaults
- procedures for customising user interface
- entities that can be manipulated in 3D space
- procedures for manipulating entities in 3D space
- procedure for using the post processor
- procedures for saving CAM files

**REQUIRED SKILLS AND KNOWLEDGE**

- CAD file conversions
- CAM file formats
- procedures to save and store CAM files

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to create 3D code files using computer aided manufacturing system. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 3D code files or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Entities**

Arcs and lines and primitives such as spheres, surfaces or solids, cones, cylinders and boxes

**Unit Sector(s)****Unit sector****Co-requisite units**

<b>Co-requisite units</b>	



<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Drawing, drafting and design
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## MEM09143A Represent aeronautical engineering designs

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency covers the skills and knowledge required to represent the design of aeronautical engineering products, processes, systems or services using appropriate graphical techniques, specifications and documentation. Work would typically be carried out as part of a design or engineering support team.

### Application of the Unit

Competency in this unit includes contribution to the full design process by the creation of documentation, graphics and specifications representing products, processes, systems or services in support of the planning and design processes within aeronautical engineering. Graphics may be produced using manual or computer-aided design (CAD) software and techniques.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM16008A	Interact with computing technology
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

1	Clarify product, process, system or service design requirements	1.1	Discuss and clarify the design specification of the required product, process, system or service with the client and design team
2	Apply graphical techniques to produce the initial product, process, system or service design representation	2.1	Ensure the initial graphical representation satisfies the design specification, manufacturing and operational requirements, safety and related standards
		2.2	Perform engineering calculations and use engineering references, standards and codes appropriately to determine dimensions, limits and fits, surface textures, datum references and geometric tolerances
		2.3	Identify materials, manufacturing methods and processes for initial design representation
		2.4	Prepare initial production graphics, specifications, and operating and maintenance instructions/manuals in accordance with the agreed design concept and organisational requirements using chosen graphical techniques
3	Validate the product, process, system or service representation	3.1	Confirm suitability of the product, process, system or service design graphical representation with the client, other team members and organisational requirements
4	Develop, validate, implement and file design graphics and specifications and procedural documentation	4.1	Prepare design graphics, specifications and instructions for the product, process, system or service in accordance with the agreed design concept and organisational requirements, and incorporate feedback on initial design graphics and documents
		4.2	Check production graphics, specifications and instructions for the product, process, system or service with the client, design team and other affected persons for suitability prior to implementation
		4.3	Respond to implementation installation and commissioning feedback in accordance with organisational requirements
		4.4	Maintain validated production graphics, specifications

		and instructions for the product process, system or service throughout the implementation, installation and commissioning processes, and process and file in accordance with organisational requirements
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## Required Skills and Knowledge

Required knowledge includes:

- the procedures for collaborating with the client and other staff in the selection of the preferred option
- significance of graphical representations of designs in terms of procedural requirements, design objectives and client or contractual requirements
- relevant manufacturing and operational requirements, safety and related standards
- the functional operation of the component/assembly to be drawn
- surfaces that are to be in contact or separated
- the appropriate type of fit for contacting surfaces, and reasons for selecting the chosen type of fit
- the effect of surface finish on the performance/operation of surfaces
- appropriate datum points
- procedures for determining tolerances
- design functional specification
- choice of components, materials, methods and processes in terms of the range of options available and the manner in which the design specification is satisfied
- options for graphical methods of representation
- scientific principles and mathematical techniques underpinning design element choices and decisions
- required graphical representation procedures for the preparation of production drawings, specifications and operating and maintenance instructions/manuals
- clients and other people affected by the design
- organisational procedures and required communication techniques
- organisational requirements for the preparation of production drawings, specifications and operating and maintenance instructions/manuals for products and systems
- persons to be consulted and procedures for verifying and implementing production graphics, technical specifications and operational and maintenance instructions/manuals
- worksite procedures for acting on implementation, installation and commissioning feedback
- worksite procedures for the processing and filing of production graphics, specifications and operating and maintenance instructions/manuals
- file storage and archiving procedures

Required skills include:

- using appropriate communication skills for contacting and confirming specifications with

the client

- discussing the alternative options and their relative strengths and weaknesses with the client and selecting the most acceptable option chosen
- applying graphical techniques correctly
- addressing design specifications, manufacturing and operational requirements, safety and related standards appropriately in the initial graphical representations
- presenting graphical representations the dimensions, limits and fits, tolerances and surface textures, datum references and geometry tolerances as determined by design calculations and in accordance with engineering references, standards and codes
- producing initial graphical representation and documentation materials, manufacturing methods and processes and design functional specifications sufficient for client, design team and interested party consultation and validation
- producing initial graphical representation/s to organisational requirements using suitable graphical techniques
- producing initial production graphics, technical specifications and operational and maintenance instructions/manuals in accordance with worksite procedures and client needs
- using appropriate communication skills in confirming that the design graphical representation meets the needs of the client and the expectations of other team members and interested parties
- completing organisational procedures and sign-off documentation
- preparing production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements and incorporating feedback on initial design graphics
- contacting the client, design team and other affected persons and the production graphics, technical specifications and verifying operational and maintenance instructions/manuals prior to implementation
- incorporating feedback from the implementation, installation and commissioning phases into final graphics and specifications
- processing, filing and saving all graphics, specifications, instructions and related documentation in correct format and location in accordance with worksite procedures

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to represent the design of aeronautical engineering products, processes, systems or services for a range of general engineering applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with represent the design of aeronautical engineering products, processes, systems or services or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

Graphical representation	<p>Graphical representations may include:</p> <ul style="list-style-type: none"><li>• manual or CAD software and techniques, such as:<ul style="list-style-type: none"><li>• sketching and layout techniques</li><li>• reading</li><li>• interpreting drawings</li><li>• documentation and design briefs</li><li>• use of organisation protocols for graphics development</li><li>• use of industry standards and codes of practice</li><li>• multimedia presentation techniques</li><li>• basic software customisation techniques</li><li>• 3D and orthographic techniques</li><li>• basic file management techniques</li></ul></li></ul>
Design graphics, specifications and instructions	<p>Design graphics, specifications and instructions may include:</p> <ul style="list-style-type: none"><li>• those prescribed within the organisation's policies and procedures</li><li>• those required by relevant statutory regulations and requirements</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM09144A Represent avionic engineering designs

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency covers the skills and knowledge required to represent the design of avionic engineering products, processes, systems or services using appropriate graphical techniques, specifications and documentation. Work would typically be carried out as part of a design or engineering support team.

### Application of the Unit

Competency in this unit includes contribution to the full design process by the creation of documentation, graphics and specifications representing products, processes, systems or services in support of the planning and design processes within avionic engineering. Graphics may be produced using manual or computer-aided design (CAD) software and techniques.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM16008A	Interact with computing technology
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

### Employability Skills Information

This unit contains employability skills



## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Clarify product, process, system or service design requirements   | 1.1 Discuss and clarify design specification of the required product, process, system or service is discussed with the client and design team   |
| 2 Apply graphical techniques to produce the initial product, process, system or service design representation | <div style="padding-left: 20px;">2.1 Confirm initial graphical representation satisfies the design specification, manufacturing and operational requirements, safety and related standards</div> <div style="padding-left: 20px;">2.2 Perform engineering calculations using engineering references, standards and codes appropriately to determine dimensions, limits and fits, surface textures, datum references and geometric tolerances</div> <div style="padding-left: 20px;">2.3 Identify materials, manufacturing methods and processes of initial design representation</div> <div style="padding-left: 20px;">2.4 Prepare initial production graphics, specifications and operating and maintenance instructions/manuals in accordance with the agreed design concept and organisational requirements using chosen graphical techniques</div> |
| 3 Validate the product, process, system or service representation   | 3.1 Confirm suitability of the product, process, system or service design graphical representation with the client, other team members and organisational requirements  |
| 4 Develop, validate, implement and file design graphics and specifications and procedural documentation       | <div style="padding-left: 20px;">4.1 Prepare design graphics, specifications and instructions for the product, process, system or service in accordance with the agreed design concept and organisational requirements and incorporate feedback on initial design graphics and documents</div> <div style="padding-left: 20px;">4.2 Check production graphics, specifications and instructions for the product, process, system or service with the client, design team and other affected persons for suitability prior to implementation</div> <div style="padding-left: 20px;">4.3 Respond to implementation installation and commissioning feedback in accordance with</div>  |

organisational requirements

- 4.4 Maintain validated production graphics, specifications instructions for the product process, system or service are throughout the implementation, installation and commissioning processes, and process and file in accordance with organisational requirements

## Required Skills and Knowledge

Required knowledge includes:

- the procedures for collaborating with the client and other staff in the selection of the preferred option
- significance of graphical representations of designs in terms of procedural requirements, design objectives and client or contractual requirements
- relevant manufacturing and operational requirements, safety and related standards
- the functional operation of the component/assembly to be drawn
- surfaces that are to be in contact or separated
- the appropriate type of fit for contacting surfaces
- the reasons for selecting the chosen type of fit
- the effect of surface finish on the performance/operation of surfaces
- appropriate datum points
- procedures for determining tolerances
- design functional specification
- choice of components, materials, methods and processes in terms of the range of options available and the manner in which the design specification is satisfied
- options for graphical methods of representation
- scientific principles and mathematical techniques underpinning design element choices and decisions
- required graphical representation procedures for the preparation of production drawings, specifications and operating and maintenance instructions/manuals
- clients and other people affected by the design
- organisational procedures and required communication techniques
- organisational requirements for the preparation of production drawings, specifications and operating and maintenance instructions/manuals for products and systems
- persons to be consulted and procedures for verifying and implementing production graphics, technical specifications, and operational and maintenance instructions/manuals
- worksite procedures for acting on implementation, installation and commissioning feedback
- worksite procedures for the processing and filing of production graphics, specifications and operating and maintenance instructions/manuals
- file storage and archiving procedures

**Required skills include:**

- using appropriate communication skills for contacting and confirming specifications with the client
- discussing the alternative options and their relative strengths and weaknesses with the client and selecting the most acceptable option chosen
- applying graphical techniques correctly
- addressing design specifications, manufacturing and operational requirements, safety and related standards appropriately in the initial graphical representations
- presenting the graphical representations the dimensions, limits and fits, tolerances and surface textures, datum references and geometry tolerances as determined by design calculations and in accordance with engineering references, standards and codes
- producing initial graphical representation and documentation materials, manufacturing methods and processes and design functional specification sufficient for client, design team and interested party consultation and validation
- producing initial graphical representations to organisational requirements using suitable graphical techniques
- producing initial production graphics, technical specifications and operational and maintenance instructions/manuals in accordance with worksite procedures and client needs
- using appropriate communication skills in confirming that the design graphical representation meets the needs of the client and the expectations of other team members and interested parties
- completing organisational procedures and sign-off documentation
- preparing production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements and incorporating feedback on initial design graphics
- contacting the client, design team and other affected persons and the production graphics, technical specifications and verifying operational and maintenance instructions/manuals prior to implementation
- incorporating feedback from the implementation, installation and commissioning phases into final graphics, specifications
- processing, filing and saving all graphics, specifications, instructions and related documentation in correct format and location in accordance with worksite procedures

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to represent the design of avionic engineering products, processes, systems or services for a range of engineering applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with represent the design of avionic engineering products, processes, systems or services or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

<b>Graphical representation</b>	Graphical representation may include: <ul style="list-style-type: none"><li>• manual or CAD software and techniques, such as:<ul style="list-style-type: none"><li>• sketching and layout techniques</li><li>• reading</li><li>• interpreting of drawings</li><li>• documentation and design briefs</li><li>• use of organisation protocols for graphics development</li><li>• use of industry standards and codes of practice</li><li>• multimedia presentation techniques</li><li>• basic software customisation techniques</li><li>• 3D and orthographic techniques</li><li>• basic file management techniques</li></ul></li></ul>
<b>Design graphics, specifications and instructions</b>	Design graphics, specifications and instructions may include: <ul style="list-style-type: none"><li>• those prescribed within the organisation's policies and procedures</li><li>• those required by relevant statutory regulations and requirements</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM09153A Apply computer-aided modelling and data management techniques to aeronautical engineering designs

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency covers the skills and knowledge required to apply computer-aided design (CAD) modelling and data management techniques to the design of aeronautical engineering products, processes, systems or services.

### Application of the Unit

Competency in this unit includes contribution to the full design process by the creation of models, graphics, documentation and specifications representing aeronautical engineering products, processes, systems or services in support of the planning and design processes.

Work would typically be carried out as part of a design or engineering support team.

The data generated from the modelling process would be managed according to organisation procedures and contractual or agreed customer requirements.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM09143A	Represent aeronautical engineering designs
MEM16008A	Interact with computing technology
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| 1 Clarify product, process, system or service design requirements | 1.1 Discuss and clarify design specifications of the required product, process, system or service with the client and design team  |
| 2 Produce initial product, process, system or service CAD model   | <div>2.1 Apply CAD modelling and data management techniques to suit given task</div> <div>2.2 Confirm initial CAD model and graphical representation satisfies the design specification, manufacturing and operational requirements, safety, environmental and related standards</div> <div>2.3 Determine design parameters for the model using engineering calculations and engineering references, standards and codes</div> <div>2.4 Identify materials, manufacturing methods and processes for initial design model</div> <div>2.5 Ensure initial design model provides for assembly and system form, fit, functional, load, service life and maintainability requirements</div> <div>2.6 Prepare initial production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements using organisation standards</div> <div>2.7 Customise CAD software appropriately to suit task requirements</div> <div>2.8 Manage and distribute CAD-generated data according to organisation protocols and access privileges, and contractual or agreed client requirements</div> |
| 3 Validate the product, process, system or service model          | 3.1 Confirm suitability of the product, process, system or service design model and graphical representation with the client, other team members and interested  |

parties

- |   |   |
|---|---|
| 4 Develop, validate, implement and file model data, production graphics and specifications and procedural documentation | <div style="margin-left: 20px;">4.1 Prepare production model and graphics, specifications and instructions for the product, process, system or service in accordance with the agreed design concept and organisational requirements and incorporate feedback on initial design graphics</div> <div style="margin-left: 20px;">4.2 Check production model or graphics, specifications and instructions for the product, process, system or service with the client, design team and other affected persons for suitability prior to implementation</div> <div style="margin-left: 20px;">4.3 Respond to implementation installation and commissioning feedback in accordance with organisational requirements</div> <div style="margin-left: 20px;">4.4 Maintain validated production model or graphics, specifications and instructions for the product process, system or service throughout the implementation, installation and commissioning processes, and process and file in accordance with organisational requirements</div> |
|---|---|

## Required Skills and Knowledge

Required knowledge includes:

- the procedures for collaborating with the client and other staff in the selection of the preferred option
- features of the CAD model relevant to design requirements, manufacturing and operational requirements, safety, environmental and related standards
- functional operation of the component/assembly model
- surfaces that are to be in contact or separated
- the appropriate type of fit for contacting surfaces
- the reasons for selecting the chosen type of fit
- the effect of surface finish on the performance/operation of component/assembly
- appropriate datum points
- the procedures for determining tolerances
- design functional specification
- components, materials, methods and processes in terms of the range of options available and the manner in which the design specification is satisfied
- options for graphical methods of representation
- scientific principles and mathematical techniques underpinning design element choices and decisions



- graphical representation procedures for the preparation of production drawings, specifications and operating and maintenance instructions/manuals related to the original design brief
- procedures for setting/customising CAD system
- use of standard library files
- management systems for CAD data including access privileges and protocols in terms of organisational procedures, contractual or agreed client requirements, and project requirements for concurrent access to data
- clients and other people affected by the design
- organisational procedures and required communication techniques
- organisational requirements for the preparation of production drawings, specifications and operating and maintenance instructions/manuals for products and systems
- persons to be consulted and procedures for verifying and implementing production graphics, technical specifications and operational and maintenance instructions/manuals
- worksite procedures for acting on implementation, installation and commissioning feedback
- worksite procedures for the processing and filing of production graphics, specifications and operating and maintenance instructions/manuals
- file storage and archiving procedures

Required skills include:

- using appropriate communication skills in contacting and confirming specifications with the client
- discussing the alternative options and their relative strengths and weaknesses with the client and selecting the most acceptable option
- addressing design specifications, manufacturing and operational requirements, safety and related standards appropriately in the initial model, documents and multimedia presentations
- presenting the graphical representations appropriately in terms of the dimensions, limits and fits, tolerances and surface textures, datum references and geometry tolerances as determined by design calculations and in accordance with engineering references, standards and codes
- addressing materials, manufacturing methods, processes and design functional specifications in initial model and documentation sufficient for client, design team and interested party consultation and validation
- producing initial model, technical specifications and operational and maintenance instructions/manuals in accordance with design concept, worksite procedures and client needs
- setting up the CAD system and data management system appropriately, and customising according to organisational standards, contractual or agreed client requirements
- using library files
- setting up the CAD data management system with appropriate protocols and access privileges
- confirming that the design graphical representation meets the needs of the client and the expectations of other team members and interested parties

- completing organisational procedures and sign-off documentation
- preparing production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements and incorporating feedback on initial design graphics
- verifying production graphics, technical specifications and operational and maintenance instructions/manuals prior to implementation
- incorporating feedback from the implementation, installation and commissioning phases into final graphics and specifications
- processing, filing and saving all graphics, specifications, instructions and related documentation in correct format and location in accordance with worksite procedures

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply CAD modelling and data management techniques to a range of aeronautical engineering designs. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Competency should be assessed in the work environment or simulated work environment using tools and equipment specified in maintenance documentation. It is also expected that general purpose tools and test equipment found in most routine situations would be used where appropriate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying CAD modelling and data management techniques to aeronautical engineering designs or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

<b>Modelling and data management techniques</b>	Modelling and data management techniques may include: <ul style="list-style-type: none"><li>• selecting appropriate modelling software and technique</li><li>• generating model and data</li><li>• post-processing</li><li>• generation of annotated 2D images from model</li><li>• customisation of user environment to organisational standards and customer requirements</li><li>• incorporation of standard components and library files</li><li>• use of programming and macros</li><li>• setting up parametric models</li><li>• presentation techniques, including multimedia using CAD data, transfer and management of data</li></ul>
<b>Graphical representation</b>	Graphical representation may include: <ul style="list-style-type: none"><li>• CAD, drawing and design techniques to relevant Australian and/or ISO standards or equivalent</li></ul>
<b>Production graphics, specifications and instructions</b>	Production graphics, specifications and instructions may include: <ul style="list-style-type: none"><li>• those prescribed within the organisation's policies and procedures</li><li>• those required by relevant statutory regulations and requirements</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09154A Apply computer-aided modelling and data management techniques to avionic engineering designs**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply computer-aided design (CAD) modelling and data management techniques to the design of avionic engineering products, processes, systems or services.

### **Application of the Unit**

Competency in this unit includes contribution to the full design process by the creation of models, graphics, documentation, and specifications representing avionic engineering products, processes, systems or services in support of the planning and design processes.

Work would typically be carried out as part of a design or engineering support team.

The data generated from the modelling process would be managed according to organisation procedures and contractual or agreed customer requirements.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM09144A	Represent avionic engineering designs
MEM16008A	Interact with computing technology
MEM30007A	Select common engineering materials
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| 1 Clarify product, process, system or service design requirements | 1.1 Discuss and clarify design specifications of the required product, process, system or service with the client and design team  |
| 2 Produce initial product, process, system or service CAD model   | <div>2.1 Apply CAD modelling and data management techniques to suit given task</div> <div>2.2 Confirm initial CAD model and graphical representation satisfies the design specification, manufacturing and operational requirements, safety, environmental and related standards</div> <div>2.3 Determine design parameters for the model using engineering calculations and engineering references, standards and codes</div> <div>2.4 Identify materials, manufacturing methods and processes for initial design model</div> <div>2.5 Ensure initial design model provides for assembly and system form, fit, functional, load, service life and maintainability requirements</div> <div>2.6 Prepare initial production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements using organisation standards</div> <div>2.7 Customise CAD software appropriately to suit task requirements</div> <div>2.8 Manage and distribute CAD generated data according to organisation protocols and access privileges, contractual or agreed client requirements</div> |
| 3 Validate the product, process, system or service model          | 3.1 Confirm suitability of the product, process, system or service design model and graphical representation with the client, other team members and interested  |

parties

- |   |   |
|---|---|
| 4 Develop, validate, implement and file model data, production graphics and specifications and procedural documentation | <div style="margin-left: 20px;">4.1 Prepare production model and graphics, specifications and instructions for the product, process, system or service in accordance with the agreed design concept and organisational requirements and incorporate feedback on initial design graphics</div> <div style="margin-left: 20px;">4.2 Check production model or graphics, specifications and instructions for the product, process, system or service with the client, design team and other affected persons for suitability prior to implementation</div> <div style="margin-left: 20px;">4.3 Respond to implementation installation and commissioning feedback in accordance with organisational requirements</div> <div style="margin-left: 20px;">4.4 Maintain validated production model or graphics, specifications and instructions for the product process, system or service throughout the implementation, installation and commissioning processes, and process and file in accordance with organisational requirements</div> |
|---|---|

## Required Skills and Knowledge

Required knowledge includes:

- the procedures for collaborating with the client and other staff in the selection of the preferred option
- features of the CAD model relevant to design requirements, manufacturing and operational requirements, safety, environmental and related standards
- functional operation of the component/assembly model
- surfaces that are to be in contact or separated
- appropriate type of fit for contacting surfaces
- reasons for selecting the chosen type of fit
- effect of surface finish on the performance/operation of component/assembly
- appropriate datum points
- procedures for determining tolerances
- design functional specification
- components, materials, methods and processes in terms of the range of options available and the manner in which the design specification is satisfied
- options for graphical methods of representation
- scientific principles and mathematical techniques underpinning design element choices and decisions

- graphical representation procedures for the preparation of production drawings, specifications and operating and maintenance instructions/manuals related to the original design brief
- procedures for setting/customising CAD system
- use of standard library files
- management systems for CAD data, including access privileges and protocols in terms of organisational procedures, contractual or agreed client requirements, and project requirements for concurrent access to data
- clients and other people affected by the design
- organisational procedures and required communication techniques
- organisational requirements for the preparation of production drawings, specifications and operating and maintenance instructions/manuals for products and systems
- persons to be consulted and procedures for verifying and implementing production graphics, technical specifications and operational and maintenance instructions/manuals
- worksite procedures for acting on implementation, installation and commissioning feedback
- worksite procedures for the processing and filing of production graphics, specifications and operating and maintenance instructions/manuals
- file storage and archiving procedures

Required skills include:

- using appropriate communication skills in contacting and confirming specifications with the client
- discussing the alternative options and their relative strengths and weaknesses with the client and selecting the most acceptable option
- addressing design specifications, manufacturing and operational requirements, safety and related standards appropriately in the initial model, documents and multimedia presentations
- presenting the graphical representations appropriately in terms of the dimensions, limits and fits, tolerances and surface textures, datum references and geometry tolerances as determined by design calculations and in accordance with engineering references, standards and codes
- addressing materials, manufacturing methods, processes and design functional specifications in initial model and documentation sufficient for client, design team and interested party consultation and validation
- producing initial model, technical specifications and operational and maintenance instructions/manuals in accordance with design concept, worksite procedures and client needs
- setting up the CAD system and data management system appropriately, and customising according to organisational standards, contractual or agreed client requirements
- using library files
- setting up the CAD data management system with appropriate protocols and access privileges
- confirming that the design graphical representation meets the needs of the client and the expectations of other team members and interested parties



- completing organisational procedures and sign-off documentation
- preparing production graphics, specifications and instructions in accordance with the agreed design concept and organisational requirements, and incorporating feedback on initial design graphics
- verifying production graphics, technical specifications and operational and maintenance instructions/manuals prior to implementation
- incorporating feedback from the implementation, installation and commissioning phases into final graphics and specifications
- processing, filing and saving all graphics, specifications, instructions and related documentation in correct format and location in accordance with worksite procedures

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply CAD modelling and data management techniques to a range of avionic engineering designs. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Competency should be assessed in the work environment or simulated work environment using tools and equipment specified in maintenance documentation. It is also expected that general purpose tools and test equipment found in most routine situations would be used where appropriate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying CAD modelling and data management techniques to avionic engineering designs or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Modelling and data management techniques</b>	<p>Modelling and data management techniques may include:</p> <ul style="list-style-type: none"><li>• selecting appropriate modelling software and technique</li><li>• generating model and data</li><li>• post-processing</li><li>• generation of annotated 2D images from model</li><li>• customisation of user environment to organisational standards and customer requirements</li><li>• incorporation of standard components and library files</li><li>• use of programming and macros</li><li>• setting up parametric models</li><li>• presentation techniques, including multimedia using CAD data, transfer and management of data</li></ul>
<b>Graphical representation</b>	<p>Graphical representation may include:</p> <ul style="list-style-type: none"><li>• CAD, drawing and design techniques to relevant Australian and/or ISO standards or equivalent</li></ul>
<b>Production graphics, specifications and instructions</b>	<p>Production graphics, specifications and instructions may include:</p> <ul style="list-style-type: none"><li>• those prescribed within the organisation's policies and procedures</li><li>• those required by relevant statutory regulations and requirements</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09155A Prepare mechanical models for computer-aided engineering (CAE)**

### **Modification History**

Release 1 - New unit. Replaces MEM09151A but not equivalent

### **Unit Descriptor**

This unit of competency covers the application of mechanical modelling techniques for computer-aided engineering (CAE) purposes. It includes model creation for purposes such as computer-aided manufacturing (CAM) and computer numerical control (CNC) applications, rapid prototyping and stress analysis, and as a basis for generating orthogonal drawings.

### **Application of the Unit**

This unit applies to modelling of mechanical, maintenance and manufacturing engineering products, plant and system for CAE applications. It is suitable for people working in design drafting and those pursuing technical qualifications and careers at engineering technician level.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23004A Apply technical mathematics

MEM23109A Apply engineering mechanics principles

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential

Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                           |     |  |
|---|---------------------------|-----|--|
| 1 | Identify model parameters | 1.1 | Identify the engineering context of computer modelling   |
|   |                           | 1.2 | Identify sustainability issues related to required models  |
|   |                           | 1.3 | Identify work health and safety (WHS) and regulatory requirements related to modelling processes and materials                   |
|   |                           | 1.4 | Identify the virtual or physical model parameters, form, function and features   |
|   |                           | 1.5 | Identify required model generation processes, including any required graphics generation, post-processing and physical modelling |
|   |                           | 1.6 | Identify licensed technical and professional assistance for advice, as required  |
| 2 | Develop model             | 2.1 | Generate initial graphical model   |
|   |                           | 2.2 | Undertake initial consultation on model with stakeholders and adjust, as required  |
|   |                           | 2.3 | Prepare model for intended purpose   |
|   |                           | 2.4 | Trial model for purpose and complete investigative analysis or produce physical model  |
|   |                           | 2.5 | Evaluate model against design criteria with stakeholders and make adjustments, as required                                       |
|   |                           | 2.6 | Engage appropriate licensed technical and professional assistance for advice, as required  |
| 3 | Finalise modelling        | 3.1 | Prepare final model  |
|   |                           | 3.2 | Report and demonstrate results   |

- 3.3 Provide documentation, instructions, models and files, as required
- 3.4 Obtain sign-off

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reviewing features, functions and context of engineering modelling, including imminent future developments
- comparing available software, functions and features
- communicating, participating and negotiating with:
  - stakeholders, team, cross-function support groups and experts
  - appropriate licensed technicians and professionals
- modelling using a comprehensive range of techniques, such as:
  - creating and manipulating 3-D entities
  - using library files and adaptations
  - accessing supplier catalogues and databases
- creating dimensioned orthographic projections from model
- extracting dimensional properties from model:
  - post-processing model for analysis or physical modelling
- finalising modelling by:
  - completing work
  - gaining approval and commissioning work
  - providing documentation and reports, as required
  - obtaining sign-off

### Required knowledge

Required knowledge includes:

- advantages and disadvantages of CAM using modelling compared to traditional manufacturing methods
- implications to be taken into account when modelling (e.g. efficiency of production, generation of waste and life cycle considerations)
- typical mechanical components, assemblies and layouts suitable for modelling

- software functions and features
- model creation techniques, including:
  - using and manipulating coordinate systems
  - creating 3-D entities, ruled and revolved surfaces
  - creating solids, editing and combining solids
  - manipulating entities and solids
  - library files
  - manipulations of solids and library files
  - 3-D graphics from models, including rotated views and sections
  - dimensioned orthographic representations from models
- typical modelling processes, including:
  - computer modelling
  - post-processing
  - prototyping and model manufacture
- mathematical model analysis options, such as:
  - finite analysis of heat flows
  - finite analysis of stresses and deflections
- physical modelling options
- traditional, current and emerging modelling methods
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements relevant to modelling task
- job requirements that may create a need for licensed technical and professional services assistance
- modelling compared to traditional representation methods, including:
  - pen and pencil graphics compared to wire frame, surface and solid models
  - computer animations compared to transparent overlay models to test clearances and motions
  - solid models compared to isometric representations
  - computer library files compared to the use of reference charts and catalogue information

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce a variety of mechanical, manufacturing and
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	<p>maintenance-related models that are consistent with design information and relevant standards and conventions.</p>
<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• review features, functions and context of engineering modelling</li> <li>• compare available software, functions and features</li> <li>• communicate, participate and negotiate with stakeholders, team, cross-function support groups and experts, appropriate licensed technicians and professionals</li> <li>• model using a comprehensive range of techniques</li> <li>• create dimensioned orthographic projections from model</li> <li>• extract dimensional properties from model</li> <li>• post-process model for analysis or physical modelling</li> <li>• complete work, commission and gain approval, document and report, and obtain sign-off</li> <li>• identify future developments in modelling.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and WHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<p><b>Method of assessment</b></p>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> </ul>



	<ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Models</b>	<p>Models may be:</p> <ul style="list-style-type: none"> <li>• virtual, such as computer generated solids models</li> <li>• physical models developed from the virtual model data</li> </ul>
<b>Model purpose</b>	<p>Models covered by this unit include mechanical, maintenance and manufacturing engineering products, plant and system models. Examples of models include:</p> <ul style="list-style-type: none"> <li>• computer model of a cavity mould for finite analysis of heat flows</li> <li>• computer model of a container, vehicle or frame for finite analysis of stresses and deflections</li> <li>• physical models of components produced for form, fit or aesthetic purposes</li> <li>• physical models, such as a once-off vehicle body panel,</li> </ul>

	<p>produced ready and fit for purpose</p> <ul style="list-style-type: none"> <li>physical models, such as a sintered metal moulds or die capable of producing a limited run of production components</li> </ul>
<b>Features, functions and context of engineering modelling</b>	<p>Features, functions and context of mechanical modelling include:</p> <ul style="list-style-type: none"> <li>techniques used for mechanical modelling</li> <li>sustainability implications of modelling</li> <li>WHS and regulatory requirements related to modelling processes and materials</li> <li>model parameters, form, function and features, virtual or physical</li> <li>processes required which may include those for generating graphics, post-processing and physical modelling</li> <li>required licensed technical and professional assistance</li> </ul>
<b>Post-processor</b>	<p>A post-processor or code generator converts programmed instructions generated by CAM software or CAD package into CNC program code to control a machine tool</p>
<b>Post-processing model for analysis or physical modelling</b>	<p>Examples of post-processing model for analysis or physical modelling include:</p> <ul style="list-style-type: none"> <li>setting up model with physical properties, mesh and nodes for finite element analysis (FEA)</li> <li>processing dimensional data to create 3-D code for CAM operations</li> <li>post-processing to create CNC data files to control CNC devices, including mills, lathes, machining centres, lasers, ultrasonic cutters and routers</li> <li>modelling for rapid prototyping</li> </ul>
<b>Rapid prototyping</b>	<p>A variety of rapid prototyping processes are available, including:</p> <ul style="list-style-type: none"> <li>selective laser sintering (SLS) which uses thermoplastics and metal powders</li> <li>fused deposition modelling (FDM) which uses thermoplastics and eutectic metals</li> <li>stereolithography (SL) which uses a photopolymer</li> <li>laminated paper manufacturing (LPM) which uses paper</li> </ul>

	<ul style="list-style-type: none"> <li>• electron beam melting (EBM) which uses titanium alloys</li> <li>• 3-D printing (3-DP) which uses a variety of materials</li> </ul>
<b>Criteria for mechanical designs</b>	<p>Criteria for mechanical designs may include:</p> <ul style="list-style-type: none"> <li>• function</li> <li>• aesthetics</li> <li>• manufacturability and maintainability</li> <li>• marketability</li> <li>• sustainability</li> <li>• cost constraints</li> <li>• ergonomics, anthropometrics and physiology</li> <li>• facilities, plant and skills available</li> <li>• safety and risk</li> </ul>
<b>Mechanical components, assemblies and layouts</b>	<p>Mechanical assemblies may include:</p> <ul style="list-style-type: none"> <li>• chain drives, gear sets, pulley and belt drives</li> <li>• threads, fasteners and springs</li> <li>• shafts, keyways and splines</li> <li>• structural sections</li> <li>• machines, drives and transmissions</li> <li>• materials handling equipment, including belt conveyors, augers and pneumatic conveyors</li> <li>• guards, handrails and platforms</li> <li>• structures, vessels and tanks</li> <li>• fan, ventilation, air conditioning service and ducting</li> <li>• production process layouts</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano</li> </ul> </li> </ul>

	<p>materials</p> <ul style="list-style-type: none"> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>other relevant regulations and standards</li> <li>industry codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task</p>
<b>Modelling and related software</b>	<p>Modelling and related software may include:</p> <ul style="list-style-type: none"> <li>lumped parameter model</li> <li>empirical, random data tested model</li> <li>FEA software</li> <li>model-based design</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09156A Prepare mechatronic models for computer-aided engineering (CAE)**

### **Modification History**

Release 1 - New unit. Replaces MEM09152A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the application of techniques for mechatronic modelling for computer-aided engineering (CAE) purposes. It includes consideration of the CAE purposes for which the model is required, such as automated mechanisms, robots or system control and data acquisition (SCADA) environments, printed circuit board manufacture and assembly, and as a basis for generating orthogonal drawings.

### **Application of the Unit**

This unit applies to modelling of mechatronic or automation systems and devices for CAE applications. It is suitable for people working in design drafting and those pursuing careers and qualifications in mechatronics, automated systems or systems maintenance at engineering technician level.

Prior or concurrently developed competence in graphics, workshop, electrical and electronic fundamentals, engineering science, mathematics and mechanical components, and manufacturing plant is required.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanics principles
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                               |     |   |
|---|-------------------------------|-----|---|
| 1 | Identify the model parameters | 1.1 | Investigate applications for modelling in mechatronics  |
|   |                               | 1.2 | Identify work health and safety (WHS) and regulatory requirements related to modelling processes and materials      |
|   |                               | 1.3 | Identify the virtual parameters, form, function and features  |
|   |                               | 1.4 | Identify required model generation processes required, including graphics generation and post-processing            |
|   |                               | 1.5 | Identify licensed technical and professional assistance for advice, as required                                     |
|   |                               |     |   |
| 2 | Develop model                 | 2.1 | Generate initial graphical model  |
|   |                               | 2.2 | Undertake initial consultation on model with stakeholders and adjust, as required                                   |
|   |                               | 2.3 | Prepare and trial model for intended purpose  |
|   |                               | 2.4 | Evaluate model against design criteria in consultation with stakeholders and make adjustments to model, as required |
|   |                               | 2.5 | Engage appropriate licensed technical and professional assistance for advice, as required                           |

- |   |                |     |  |
|---|----------------|-----|--|
| 3 | Finalise model | 3.1 | Prepare final model  |
|   |                | 3.2 | Report and demonstrate results                                     |
|   |                | 3.3 | Provide documentation, instructions, models and files, as required |
|   |                | 3.4 | Obtain sign-off  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- investigating the uses of mechatronic models
- reviewing features, functions and context of mechatronic modelling, including imminent future developments
- comparing available software, functions and features
- communicating, participating and negotiating with:
  - stakeholders, team, cross-function support groups and experts
  - appropriate licensed technicians and professionals
- modelling using a comprehensive range of techniques, such as:
  - creating and manipulating 3-D entities
  - using library files and adaptations
  - accessing supplier catalogues and databases
- creating dimensioned orthographic projections from model
- extracting dimensional properties from model
- post-processing model for analysis or physical modelling
- finalising modelling by:
  - completing work
  - gaining approval and commissioning work
  - providing documentation and reports, as required
  - obtaining sign-off

### Required knowledge

Required knowledge includes:

- advantages and disadvantages of computer-aided manufacturing (CAM) using modelling

- compared to traditional manufacturing methods
- implications to be taken into account when modelling (e.g. efficiency of production, generation of waste, life cycle considerations, and accessing supplier catalogues and databases)
- typical mechatronic components, assemblies and layouts suitable for modelling
- software functions and features
- model creation techniques, including:
  - using and manipulating coordinate systems
  - creating 3-D entities, ruled and revolved surfaces
  - creating solids, editing and combining solids
  - manipulating entities and solids
  - library files
  - manipulations of solids and library files
  - 3-D graphics from models, including rotated views and sections
  - dimensioned orthographic representations from models
- typical modelling processes, including:
  - computer modelling
  - post-processing
- virtual model options, including automated systems simulation of motions:
  - post-processing to create numeric control (NC) data files to computer numeric control (CNC) circuit board assembly or gantry robot assembly of boards
  - rapid prototyping options
  - finite element analysis (FEA) using software
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements, relevant to modelling task
- job requirements that may create a need for licensed technical and professional services
- modelling compared to traditional representation methods, including:
  - pen and pencil graphics compared to wire frame, surface and solid models
  - computer animations compared to transparent overlay mobiles to test clearances and motions
  - solid models compared to isometric representations
  - computer library files compared to the use of reference charts and catalogue information

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce a variety of mechatronic-related models that are
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	consistent with design information and relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate competently and consistently:</p> <ul style="list-style-type: none"> <li>• review features, functions and context of mechatronic modelling</li> <li>• compare available software, functions and features</li> <li>• communicate, participate and negotiate with stakeholders, team, cross-function support groups and experts, appropriate licensed technicians and professionals</li> <li>• model using a comprehensive range of techniques</li> <li>• create dimensioned orthographic projections from model</li> <li>• extract dimensional properties from model</li> <li>• post-process model for analysis or physical modelling</li> <li>• complete work, commission and gain approval, document and report, and obtain sign-off</li> <li>• identify future developments in modelling.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and WHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other</li> </ul>

	<p>circumstances.</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Models</b>	<p>Models may be:</p> <ul style="list-style-type: none"> <li>virtual, such as computer generated solids models</li> <li>physical models developed from the virtual model data</li> </ul>
<b>Model purpose</b>	<p>Models covered by this unit include mechanical, maintenance and manufacturing engineering products, plant and system models.</p> <p>Examples of models include:</p> <ul style="list-style-type: none"> <li>virtual robot model for motion simulation</li> <li>automated process simulation</li> <li>printed circuit board model for component fit or robot assembly</li> </ul>
<b>Features, functions and context of engineering modelling</b>	<p>Features, functions and context of mechanical modelling include:</p> <ul style="list-style-type: none"> <li>techniques used for mechanical modelling</li> <li>sustainability implications of modelling</li> <li>WHS and regulatory requirements related to modelling processes and materials</li> <li>model parameters, form, function and features, virtual or physical</li> <li>processes required which may include those for generating</li> </ul>

	<p>graphics, post-processing and physical modelling</p> <ul style="list-style-type: none"> <li>• required licensed technical and professional assistance</li> </ul>
<b>Post-processor</b>	A post-processor or code generator converts programmed instructions generated by CAM software or computer-aided design (CAD) package into CNC program code to control a machine tool
<b>Post-processing model for analysis or physical modelling</b>	<p>Examples of post-processing model for analysis or physical modelling include:</p> <ul style="list-style-type: none"> <li>• setting up robotic model for motion analysis</li> <li>• processing dimensional data to create 2-D or 3-D code for CAM operations, such as printed circuit board manufacture</li> <li>• post-processing to create NC data files to control NC devices, including mills, lathes, machining centres, lasers, ultrasonic cutters and routers</li> <li>• modelling for rapid prototyping</li> </ul>
<b>Rapid prototyping</b>	<p>A variety of rapid prototyping processes are available, including:</p> <ul style="list-style-type: none"> <li>• selective laser sintering (SLS) which uses thermoplastics and metal powders</li> <li>• fused deposition modelling (FDM) which uses thermoplastics and eutectic metals</li> <li>• stereolithography (SLA) which uses a photopolymer</li> <li>• laminated paper manufacturing (LPM) which uses paper</li> <li>• electron beam melting (EBM) which uses titanium alloys</li> <li>• 3-D printing (3-DP) which uses a variety of materials</li> </ul>
<b>Criteria for mechatronic designs</b>	<p>Criteria for mechatronic designs may include:</p> <ul style="list-style-type: none"> <li>• safety and risk</li> <li>• function</li> <li>• aesthetics</li> <li>• manufacturability and maintainability</li> <li>• marketability</li> <li>• sustainability</li> <li>• cost constraints</li> <li>• ergonomics, anthropometrics and physiology</li> <li>• facilities, plant and skills available</li> </ul>

<b>Mechatronic components, assemblies and layouts</b>	<p>Mechatronic assemblies may include:</p> <ul style="list-style-type: none"> <li>• electrical motors and fluid power actuators</li> <li>• printed circuit boards</li> <li>• electrical, electronic and electro fluid controls</li> <li>• chain drives, gear sets, pulley and belt drives</li> <li>• structural sections</li> <li>• mechatronic assembly models, including robots, automated mechanisms and machines</li> <li>• materials handling equipment, including belt conveyors, augers and pneumatic conveyors</li> <li>• manufacturing plant and process layouts</li> <li>• manufactured product with embedded controller</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• other relevant regulations and standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> </ul>

<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>Modelling and related software</b>	Modelling and related software may include: <ul style="list-style-type: none"><li>• lumped parameter model</li><li>• empirical, random data tested model</li><li>• FEA software</li><li>• model-based design</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09157A Perform mechanical engineering design drafting**

## **Modification History**

Release 1 New unit. Replaces MEM09141A but not equivalent.

## **Unit Descriptor**

This unit of competency covers the preparation of design drawings or graphics used in the mechanical engineering, manufacturing engineering and related industry sectors. The unit includes working with a design brief or concept prepared by an engineer or other designer as well as the specification of items, functions, limits, fits, tolerances, and other engineering information required for the eventual production of fully detailed drawings. The unit requires the design drawing to be performed using appropriate computer-aided design (CAD) and other drafting techniques that include sketching, computer graphics and the application of drawing standards.

## **Application of the Unit**

This unit applies to the undertaking of designated design tasks and the specification in design drawings and graphics of mechanical plant, products, projects, system changes or improvements in domestic, commercial, industrial, agricultural, medical, military or entertainment industries. For ease of reference the term 'drawing' is used in this unit.

The design drawing is normally undertaken at the direction of an engineer, scientist or other designer who will pass on a concept brief to the design draftsman. The concept brief may be a sketch, hard copy plan or document, or a CAD generated file. The unit requires design drawings to be produced using appropriate CAD software. Depending on the task or project, production or supervision of hard copy drawings may also be required.

The unit also includes supervision of detailed drawing production and managing of requests for further information from detailed draftsmen.

This may require completion of appropriate engineering design or evaluation units from the MEM05 Metal and Engineering Training Package depending on the design drawing task and previous industrial experience.

This unit does not cover the production of detailed drawings (often known as shop drawings). Where detailed drawing skills are required the relevant MEM detailed drawing units should be selected.

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Clarify the design drawing task	1.1	Receive design drawing brief and check completeness of information
		1.2	Confirm software and file formats to be used for design drawings with designer and detail draftspersons
		1.3	Determine stakeholders to be consulted in design drawing process
		1.4	Assess work health and safety (WHS), regulatory, sustainability or environmental issues relevant to design task
		1.5	Confirm design drawing brief and provide preliminary advice on feasibility
2	Produce mechanical or maintenance engineering-related drawings	2.1	Determine range of engineering drawings required
		2.2	Produce orthogonal drawings of mechanical components and assemblies to relevant standards using appropriate computer graphical techniques
		2.3	Produce 3-D images of mechanical components and assemblies to relevant standards using computer graphical techniques

- |   |  |     |  |
|---|--|-----|--|
|   |  | 2.4 | Determine and apply required dimensioning, tolerancing for limits and fits, surface finish and weld symbols, and other required graphical convention information appropriate to mechanical or maintenance engineering applications |
|   |  | 2.5 | Seek technical and professional assistance or clarification of design information, as required.  |
|   |  | 2.6 | Confirm final range of design drawings to be produced with designer, detail draftspersons and other stakeholders   |
| 3 | Provide final drawings files and documents | 3.1 | Submit final design drawings for sign-off by designer or specified authority   |
|   |  | 3.2 | Prepare CAD files for export to detailer   |
|   |  | 3.3 | Provide documentation, drawings, data files and clearances according to job requirements and enterprise drawing management system and procedures   |
| 4 | Supervise production of detail drawings    | 4.1 | Supervise production of detail drawings  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reviewing mechanical or maintenance engineering applications for required features, functions and context of engineering design drawings
- determining the range of design drawings required, including:
  - design drawings specified by designer and other requests (e.g. from clients and regulators)
  - models, views and sections required to indicate assembly, function, dimensions and materials
  - design drawings required to clearly indicate engineering design specifications to detailer



- using CAD systems, comparing and selecting available software, functions and features appropriate to the design drawing task
- developing orthographic, isometric and other 3-D graphical representations
- representing mechanical components and assemblies using sketching and computer graphics
- representing mechanical components and features using a comprehensive range of standard conventions and graphical techniques
- representing a range of mechanical assemblies using standard graphical representations
- selecting and applying design criteria to meet requirements of the design brief
- engaging appropriate licensed technical and professional assistance for advice, as required, and reporting results of review and the application of graphics techniques
- providing documentation, images and files according to job and enterprise procedures

## Required knowledge

Required knowledge includes:

- application of the role of engineering design, design drawing and detail drawing in mechanical and maintenance engineering tasks and projects, such as:
  - design specifications
  - mechanical and maintenance procedures
  - technical specifications and descriptions
- availability and features of standards related to mechanical plant and devices, design, maintenance and alteration
- AS 1100 Technical drawing, and means of locating and referencing other relevant standards
- availability and features of standards related to mechanical plant and devices, design, maintenance and alteration
- application of relevant standard for mechanical designs
- methods of representing mechanical components and assemblies using sketching and computer graphics, including all relevant symbols, conventions, abbreviations, and so on
- current and traditional methods of documentation generation and control:
  - computer library files
  - reference charts and catalogue information
  - manual drawing
  - generation of orthogonal images from models
- worksite procedures for the processing and filing of graphics, specifications and operating and maintenance instructions/manuals
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements relevant to mechanical and maintenance applications

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce a variety of graphical representations of mechanical and maintenance-related assemblies and components that are consistent with design information and relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• select and apply design criteria to meet requirements of the design brief</li> <li>• review features, functions and context of engineering drawings</li> <li>• develop orthographic, isometric and other 3-D graphical representations</li> <li>• represent mechanical components and assemblies using sketching and computer graphics</li> <li>• represent mechanical components and features using a comprehensive range of standard conventions and graphical techniques</li> <li>• represent a range of mechanical assemblies using standard graphical representations</li> <li>• recognise when to engage appropriate licensed technical and professional assistance for advice</li> <li>• provide documentation, images and files.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and</li> </ul>

	<p>accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Designer</b>	A designer is usually a professional engineer but may also be a scientist, engineering technologist, architect or other person with appropriate skills and knowledge for the design task. The term may also refer to situations where a team of designers are used to produce a design
<b>Design drawing brief</b>	<p>The design drawing brief will be communicated to the design drafts person and will include:</p> <ul style="list-style-type: none"> <li>• major and critical engineering specifications (e.g. dimensions, limits, fits, tolerances and materials)</li> <li>• required features and performance of equipment (e.g. volume, temperature and flow)</li> <li>• standards that must be adhered to</li> <li>• client requests</li> <li>• budget and project schedule</li> </ul>

	<ul style="list-style-type: none"> <li>procedures to be followed for further clarifications</li> </ul>
<b>Design drawings</b>	Design drawings is used in this unit to include all 3-D and 2-D files and hard copies produced as part of the design drawing process
<b>Design criteria for mechanical designs</b>	<p>Criteria for mechanical designs may include:</p> <ul style="list-style-type: none"> <li>function</li> <li>aesthetics</li> <li>manufacturability and maintainability</li> <li>marketability</li> <li>sustainability: <ul style="list-style-type: none"> <li>social, economic and environmental</li> <li>material and energy resources</li> </ul> </li> <li>cost constraints</li> <li>ergonomics, anthropometrics and physiology</li> <li>facilities, plant and skills available</li> <li>safety and risk</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>industry codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements applying to electrical work</li> </ul>

<b>Mechanical assemblies</b>	<p>Mechanical assemblies may include:</p> <ul style="list-style-type: none"> <li>• machines, drives and transmissions</li> <li>• materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors)</li> <li>• guards, handrails and platforms</li> <li>• structures, vessels and tanks</li> <li>• fan, ventilation, air conditioning service and ducting</li> <li>• manufacturing plant and process layouts</li> <li>• manufactured products</li> </ul>
<b>Mechanical components and features represented by standard conventions and graphical techniques</b>	<p>Mechanical components and features represented by standard conventions and graphical techniques may include:</p> <ul style="list-style-type: none"> <li>• hole basis, shaft basis and keyway tolerances and fits</li> <li>• dimensions, tolerances for limits and fits</li> <li>• materials and surface finish</li> <li>• weld symbols</li> <li>• webs, cross-sections and cutting planes</li> <li>• chain drives, gear sets, pulley and belt drives</li> <li>• threads, fasteners and springs</li> <li>• shafts, keyways and splines</li> <li>• structural sections</li> </ul>
<b>Features, functions and context of engineering design drawing</b>	<p>Features, functions and context of engineering design drawing include:</p> <ul style="list-style-type: none"> <li>• uses of design drafting for purposes, such as: <ul style="list-style-type: none"> <li>• design specifications</li> <li>• production specifications</li> <li>• maintenance procedures</li> <li>• technical specifications and descriptions</li> </ul> </li> <li>• graphical representation techniques, including orthogonal, 2-D and 3-D modelling, isometric and mechanical perspective, dimensioning, limits and fits, welding and other standard symbols</li> <li>• role of WHS and regulatory requirements, codes of practice, ministerial directives, risk assessment and registration requirements</li> <li>• availability and features of a range of standards related to mechanical plant and devices, design, maintenance and alteration</li> <li>• typical criteria for mechanical designs</li> <li>• software developments</li> <li>• current graphical methods compared with traditional methods</li> <li>• emerging developments in graphics and related engineering</li> </ul>

	software
<b>Standards and codes</b>	This refers to all relevant Australian and international standards and codes applicable to a particular design task

## Unit Sector(s)

### Competency field

**Unit sector** Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09158A Perform mechatronics engineering design drafting**

## **Modification History**

Release 1 - New unit. Replaces MEM09142A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the preparation of design drafting for mechatronic engineering and related industry sectors. The unit includes working with a design brief or concept prepared by an engineer or other designer as well as the specification of items, functions, limits, fits, tolerances, and other engineering information required for the eventual production of fully detailed drafting. The unit requires the design drafting to be performed using appropriate computer-aided design (CAD) and other drafting techniques that include sketching, computer drafting and the application of drawing standards.

## **Application of the Unit**

This unit applies to the undertaking of designated design tasks and the specification in mechatronic or automated plant, products, projects, and related system changes or improvements.

The design drafting is normally undertaken at the direction of an engineer, scientist or other designer who will pass on a concept brief to the design draftsman. The concept brief may be a sketch, hard copy plan or document, or a CAD generated file. The unit requires design drafting to be produced using appropriate CAD software. Depending on the task or project, production or supervision of hard copy drawings may also be required.

The unit also includes supervision of detailed drawing production and managing of requests for further information from detailed draftsmen.

This unit may require completion of appropriate engineering design or evaluation units from the MEM05 Metal and Engineering Training Package depending on the design drafting task and previous industrial experience.

This unit does not cover the production of detailed drawings (often known as shop drawings). Where detailed drawing skills are required the relevant MEM detailed drawing units should be selected.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Clarify the design drawing task	1.1	Receive design drafting brief and check completeness of information
		1.2	Confirm software and file formats to be used for design drafting with designer and detail draftspersons
		1.3	Determine stakeholders to be consulted in design drafting process
		1.4	Assess work health and safety (WHS), regulatory, sustainability or environmental issues relevant to design task
		1.5	Confirm design drawing brief and provide preliminary advice on feasibility
2	Produce mechatronic related drawings	2.1	Determine range of engineering drawings required
		2.2	Produce orthogonal drafting of mechatronic components and assemblies to relevant standards using appropriate computer graphical techniques
		2.3	Produce 3-D images of mechatronic components and assemblies to relevant standards using computer graphical techniques
		2.4	Determine and apply required dimensioning, tolerancing for limits and fits, surface finish and weld symbols, and other required graphical convention information



- appropriate to mechatronic engineering applications
- 2.5 Produce graphical representations and circuit diagrams for fluid, electrical and electronic control systems in accordance with the design brief
  - 2.6 Seek technical and professional assistance or clarification of design information, as required.
  - 2.7 Confirm final graphical representations with professional engineering staff and other stakeholders
- 3 Provide final drafting, files and documents
- 3.1 Submit final design drawings for sign-off by designer or specified authority
  - 3.2 Prepare CAD files for export to detailer
  - 3.3 Provide documentation, drawings, data files and clearances according to job requirements and enterprise drawing management system and procedures
- 4 Supervise production of detail drafting
- 4.1 Supervise production of detail drafting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reviewing mechatronic engineering applications for required features, functions and context of mechatronic engineering design drawings
- determining the range of design drafting required, including:
  - design drafting specified by designer and other requests (e.g. from clients and regulators)
  - models, views and sections required to indicate assembly, function, dimensions and materials
  - design drafting required to clearly indicate engineering design specifications to detailer
- using CAD systems, comparing and selecting available software, functions and features

appropriate to the design task

- developing orthographic, isometric and other 3-D graphical representations
- representing mechatronic components and assemblies using sketching and computer graphics
- representing mechatronic components and features using a comprehensive range of standard conventions and graphical techniques
- representing a range of mechatronic assemblies using standard graphical representations
- selecting and applying design criteria to meet requirements of the design brief
- engaging appropriate licensed technical and professional assistance for advice, as required
- providing documentation, images and files according to job and enterprise procedures

## Required knowledge

Required knowledge includes:

- application of the role of engineering design, design drafting and detail drafting in mechatronic tasks and projects, such as:
  - design specifications
  - mechatronic manufacture and maintenance procedures
  - technical specifications and descriptions
  - physical arrangement of mechanical, fluid, electrical and control elements
  - diagrammatic layouts of control circuits
  - actuator sequence and logical signal diagrams
- graphical representation techniques
- WHS and regulatory requirements, codes of practice, risk assessment and registration requirements relevant to mechatronic applications
- application of relevant standards for mechatronic design
- worksite procedures for the processing and filing of drafting, specifications and operating and maintenance instructions/manuals
- methods of representing mechatronic components and assemblies using sketching and computer graphics, including all relevant symbols, conventions, abbreviations, and so on
- current and traditional methods of documentation generation and control:
  - computer library files
  - reference charts and catalogue information
  - generation of orthogonal images from models
- manual drawing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

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<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce a variety of graphical representations of mechatronic-related assemblies and components that are consistent with design information and relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• select and apply design criteria to meet requirements of the design brief</li> <li>• review features, functions and context of mechatronic engineering drafting</li> <li>• develop orthographic, isometric and other 3-D graphical representations</li> <li>• represent mechatronic components and assemblies using sketching and computer graphics</li> <li>• represent mechatronic components and features using a comprehensive range of standard conventions and graphical techniques</li> <li>• represent a range of mechatronic assemblies using standard graphical representations</li> <li>• recognise when to engage appropriate licensed technical and professional assistance for advice</li> <li>• provide documentation, images and files.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of</li> </ul>

	<p>underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Designer</b>	A designer is usually a professional engineer but may also be a scientist, engineering technologist, architect or other person with appropriate skills and knowledge for the design task. The term may also refer to situations where a team of designers are used to produce a design
<b>Design drawing brief</b>	<p>The design drawing brief will be communicated to the design drafts person and will include:</p> <ul style="list-style-type: none"> <li>• major and critical engineering specifications (e.g. dimensions, limits, fits, tolerances and materials)</li> <li>• required features and performance of equipment (e.g. volume, temperature and flow)</li> <li>• control requirements and control methods</li> <li>• electrical and fluid power specifications</li> <li>• standards that must be adhered to</li> <li>• client requests</li> <li>• budget and project schedule</li> </ul>

	<ul style="list-style-type: none"> <li>procedures to be followed for further clarifications</li> </ul>
<b>Design drawings</b>	Design drawings is used in this unit to include all 3-D and 2-D files and hard copies produced as part of the design drawing process
<b>Design criteria for mechatronic designs</b>	<p>Criteria for mechatronic designs may include:</p> <ul style="list-style-type: none"> <li>function</li> <li>aesthetics</li> <li>manufacturability and maintainability</li> <li>marketability</li> <li>sustainability: <ul style="list-style-type: none"> <li>social, economic and environmental</li> <li>material and energy resources</li> </ul> </li> <li>cost constraints</li> <li>ergonomics, anthropometrics and physiology</li> <li>facilities, plant and skills available</li> <li>automation safety and risk</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Features, functions and context of engineering design drafting</b>	<p>Features, functions and context of engineering design drafting includes:</p> <ul style="list-style-type: none"> <li>uses of design drafting for purposes, such as: <ul style="list-style-type: none"> <li>design specifications</li> <li>production specifications</li> <li>maintenance procedures</li> <li>technical specifications and descriptions</li> </ul> </li> <li>graphical representation techniques, including orthogonal,</li> </ul>

	<p>2-D and 3-D modelling, isometric and mechanical perspective, dimensioning, limits and fits, welding and other standard symbols</p> <ul style="list-style-type: none"> <li>• role of WHS and regulatory requirements, codes of practice, ministerial directives, risk assessment and registration requirements</li> <li>• availability and features of a range of standards related to mechanical plant and devices, design, maintenance and alteration</li> <li>• typical criteria for mechatronic designs</li> <li>• software developments</li> <li>• emerging developments in graphics and related engineering software</li> </ul>
<b>Mechatronic components and features represented by standard conventions and graphical techniques</b>	<p>Mechatronic components and features represented by standard conventions and graphical techniques may include:</p> <ul style="list-style-type: none"> <li>• hole basis, shaft basis and keyway tolerances and fits</li> <li>• dimensioning, tolerancing for limits and fits</li> <li>• materials and surface finish</li> <li>• weld symbols</li> <li>• webs, cross-sections and cutting planes</li> <li>• chain drives, gear sets, pulley and belt drives</li> <li>• threads, fasteners and springs</li> <li>• shafts, keyways and splines</li> <li>• structural sections</li> <li>• surface finishes and welds</li> <li>• electric motors and fluid power actuators</li> <li>• electrical, electronic, electro fluid controls</li> <li>• electrical and electronic circuit components</li> </ul>
<b>Mechatronic assemblies</b>	<p>Mechatronic assemblies may include:</p> <ul style="list-style-type: none"> <li>• robots</li> <li>• automated mechanisms and machines</li> <li>• materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors)</li> <li>• fan, ventilation, air conditioning service and ducting</li> <li>• manufacturing plant and process layouts</li> <li>• manufactured product with embedded controller</li> <li>• automated machines, drives and transmissions</li> <li>• automated materials handling equipment (e.g. belt conveyors, augers and pneumatic conveyors)</li> <li>• guards, handrails and platforms for automated systems</li> <li>• automated fan, ventilation and air conditioning systems</li> <li>• automated manufacturing plant and process layouts</li> </ul>

	<ul style="list-style-type: none"><li>• mechatronic devices and products</li></ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	WHS, regulatory requirements and enterprise procedures may include: <ul style="list-style-type: none"><li>• WHS Acts and regulations</li><li>• relevant standards</li><li>• industry codes of practice</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• state and territory regulatory requirements applying to electrical work</li></ul>
<b>Standards and codes</b>	This refers to all relevant Australian and international standards and codes applicable to a particular design task

## Unit Sector(s)

### Competency field

**Unit sector**          Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09201A Work effectively in an engineering drafting workplace**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to provide drafting services according to the systems and standards expected in industry. It includes understanding work contexts, stakeholder needs, employment conditions and expectations, and the way drafting is used across different engineering disciplines.

## **Application of the Unit**

This unit is suitable for those working within a computer-aided design (CAD) or drafting work environment. It includes the acceptance of responsibility for own work, working in a team and working to meet established industry standards.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.



## Elements and Performance Criteria

- |   |                                       |   |
|---|---------------------------------------|---|
| 1 | Identify the work context and setting | 1.1 Identify the scope and nature of the organisation and describe key products and services                                  |
|   |                                       | 1.2 Identify legislation, enterprise procedures and industry standards relevant to the workplace                              |
|   |                                       | 1.3 Describe the work flow in the organisation  |
|   |                                       | 1.4 Identify key personnel and describe their role and relationship to own work   |
|   |                                       | 1.5 Evaluate impact of trends, such as technology change, work processes and environmental issues, on work practices          |
| 2 | Examine role of drafting              | 2.1 Describe roles and key responsibilities in drafting work, including processes involved in detail and design drafting work |
|   |                                       | 2.2 Identify organisation stakeholders of drafting projects and their information and service needs                           |
|   |                                       | 2.3 Interpret and use industry terminology  |
|   |                                       | 2.4 Determine the needs and features of drafting work undertaken for different engineering disciplines                        |
|   |                                       | 2.5 Describe the role of computer programs in 2-D and 3-D design and detail drafting work                                     |
| 3 | Accept responsibility for own work    | 3.1 Identify own work responsibilities, obligations, employment conditions and role within work group or area                 |
|   |                                       | 3.2 Determine work priorities and deadlines and plan work activity accordingly  |
|   |                                       | 3.3 Apply enterprise work and safety procedures when conducting work and ensure quality standards are met                     |
|   |                                       | 3.4 Access and use work information, technology and resources to complete work  |
|   |                                       | 3.5 Apply time-management skills to ensure work deadlines   |

- are met and communicate with appropriate personnel if timelines are compromised
- 3.6 Identify skill development needs and seek assistance with supervisor or other appropriate personnel
- 3.7 Minimise impact of work on the environment and conduct housekeeping to maintain workplace
- 4 Work with others
- 4.1 Identify roles of team members
- 4.2 Participate in the development and review of team goals and activities and contribute to continuous improvements
- 4.3 Contribute to team meetings using effective communication skills and with respect to varying opinions and differences
- 4.4 Address work conflicts professionally using effective communication skills, and refer to appropriate personnel if necessary
- 5 Apply safe and sustainable work practices
- 5.1 Apply safety procedures and practices at all times
- 5.2 Collaborate with others and contribute to positive work environment
- 5.3 Identify and minimise resource use in own work, and contribute to efficiency improvements
- 5.4 Comply with enterprise environmental regulations and report breaches and environmental hazards to designated personnel

## Required Skills and Knowledge

### Required skills

Required skills include:

- sourcing and disseminating information
- communicating verbally and in writing with team members, site/project managers and

suppliers

- meeting skills
- organising skills to manage own workload and individual career planning activities
- interpersonal skills in dealing with team members and others

### Required knowledge

Required knowledge includes:

- relevant legislation
- occupational health and safety (OHS) requirements for the engineering industry
- relevant statutory/regulatory authorities
- relevant codes of practice
- quality assurance procedures

### Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform work within a drafting context, according to industry standards and work expectations.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structure and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• demonstrate industry knowledge, including: <ul style="list-style-type: none"> <li>• industry size, scope of work and economic</li> </ul> </li> </ul>

	<p>issues</p> <ul style="list-style-type: none"> <li>• industry standards and codes relevant to organisation work</li> <li>• relevant legislative and regulatory provisions covering drafting work, including discrimination and equal employment opportunity</li> <li>• types of drafting in industry and work flow.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Standards and codes</b>	Standards and codes include, but are not limited to: <ul style="list-style-type: none"><li>• Australian drawing standards</li><li>• third-party manufacturing and installation standards</li><li>• company standards</li><li>• project and industry guidelines</li><li>• manufacturer catalogues and specifications</li></ul>
<b>Stakeholders</b>	Stakeholders may include: <ul style="list-style-type: none"><li>• clients</li><li>• engineers</li><li>• builders</li><li>• architects</li><li>• tradespeople</li><li>• designers</li><li>• management</li><li>• team members</li></ul>
<b>Engineering disciplines</b>	Depending on the project and brief there may not be a clear discipline for any one task with many drawing tasks covering more than one discipline. The common engineering disciplines that may be covered by this unit include: <ul style="list-style-type: none"><li>• mechanical</li><li>• air conditioning and mechanical services</li><li>• mechatronics</li><li>• electrical</li><li>• manufacturing</li><li>• fabrication</li><li>• naval architecture</li><li>• structural</li><li>• civil</li><li>• mining</li><li>• materials handling</li></ul>
<b>Responsibilities, obligations and employment conditions</b>	Responsibilities, obligations and employment conditions will vary according to the organisation and project and may include: <ul style="list-style-type: none"><li>• job description and employment arrangements</li></ul>

	<ul style="list-style-type: none"> <li>• organisation's policy relevant to work role</li> <li>• team structures</li> <li>• supervision and accountability requirements, including OHS</li> <li>• environmentally sustainable work practices</li> <li>• industrial awards</li> <li>• enterprise agreements</li> <li>• industry/workplace codes of practice</li> <li>• skills, training and competencies</li> <li>• codes of conduct</li> </ul>
<b>Communication skills</b>	<p>Communication skills may include:</p> <ul style="list-style-type: none"> <li>• active listening</li> <li>• numeracy skills to the level required to interpret workplace documents</li> <li>• verbal skills to convey meaning and add to discussion</li> <li>• reading and writing skills to the level required to interpret and contribute to work information</li> <li>• use of templates, conventions and communication protocols appropriate to the organisation, project and type of drawing</li> </ul>
<b>Efficiency improvements</b>	<p>Efficiency improvements are changes to work practices which result in:</p> <ul style="list-style-type: none"> <li>• reduction in resource consumption, including water, electricity or materials</li> <li>• waste minimisation or improved management</li> <li>• pollution controls</li> <li>• equipment maintenance and longevity</li> <li>• improved workplace layout</li> <li>• reduced transportation or movement</li> <li>• cost savings</li> <li>• increased re-use or recycling and use of renewable resources</li> <li>• greater education and understanding of sustainable work practices</li> <li>• greater measurement of resource use</li> <li>• selection of more environmentally friendly materials, resources or practices</li> <li>• prevention or minimisation of risks</li> </ul>
<b>Environmental hazards</b>	<p>Environmental hazards may include:</p> <ul style="list-style-type: none"> <li>• substances (e.g. resources, waste and by-products) that are dangerous to living things in the</li> </ul>

	<p>environment, such as humans, animals, plants and water, including storage, handling and disposal of the following substances:</p> <ul style="list-style-type: none"><li>• toxic</li><li>• corrosive</li><li>• flammable</li><li>• explosive</li><li>• other infectious or dangerous substances</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM09202A Produce freehand sketches

### Modification History

Release 1 - New unit of competency

### Unit Descriptor

This unit of competency covers the skills and knowledge required to complete freehand sketches to illustrate or communicate information to be used in engineering drafting applications. It covers standard drawing conventions and techniques to represent the subject in appropriate proportion and view.

### Application of the Unit

This unit is suitable for those working within a computer-aided design (CAD) or drafting work environment. Sketches may be used as part of the drafting process to illustrate or communicate information about design, worksite, layout plan or construction features. The unit includes the ability to apply standard drawing conventions to sketching 2-D orthogonal and pictorial freehand drawings and sectional views.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.



## Elements and Performance Criteria

1	Determine sketch requirements	1.1	Determine purpose, scope and presentation context for sketch, and the information needs of the audience
		1.2	Identify key features, dimensions and orientation, structures, services and features for inclusion
		1.3	Obtain any additional information required
		1.4	Determine suitable sketching techniques and select and prepare materials
		1.5	Access, interpret and apply compliance or safety procedures relevant to the work activity
2	Create simple sketches of pictorial, orthographic and sectional views	2.1	Prepare simple freehand sketches using standard orthogonal and pictorial conventions
		2.2	Prepare sectional details of simple structural or mechanical elements and elevations using standard orthogonal drawing practice
		2.3	Examine and apply principles of descriptive geometry to ensure correct perspective is achieved
		2.4	Apply industry specific terminology and symbols, and include specifications, as required, to convey required information
		2.5	Identify and label sketch to confirm currency and purpose
		2.6	Confirm sketch is an accurate representation of subject and applies standard drawing conventions
3	Produce sketches of geometric shaped objects	3.1	Sketch geometric shapes using correct construction techniques
		3.2	Obtain tangent points using correct drawing techniques
		3.3	Confirm sketch is an accurate representation of subject and applies standard drawing conventions

4	Produce pictorial sketches of engineering components	4.1	Select principal axes and angles
		4.2	Sketch isometric and non-isometric lines
		4.3	Construct pictorial circles and arcs
		4.4	Sketch isometric, oblique and perspective views
		4.5	Conduct calculations, as required, to ensure correct dimensions and proportions and construct and use scales for sketch
		4.6	Complete border and title blocks and confirm sketch is an accurate representation of subject and applies standard drawing conventions

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read product safety labels and instructions and to prepare sketches for presentation
- numeracy skills sufficient to determine layout issues and to deal with scaling
- applying spatial principles to achieve scale and proportion
- selecting correct media and graded pencils to produce a freehand sketch of components
- applying freehand drawing techniques and conventions in the production of sketches in pictorial, orthographic and sectional views

### Required knowledge

Required knowledge includes:

- general knowledge of the elements and principles of design and their specific application to drawing
- general knowledge of different approaches to drawing
- techniques, methods and principles of technical drawing used in descriptive geometry
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and occupational health and safety (OHS) issues associated with the tools and materials used for drawing
- quality assurance procedures
- principles of plane geometry:

- geometric shapes
- plane geometry
- geometric construction
- line types during construction
- sketch construction:
  - pictorial axes
  - pictorial angles
  - pictorial lines
  - non-pictorial lines
  - pictorial circles and arcs
- four centre method
- ordinate method:
  - sectioning pictorial shapes
- pictorial drawing:
  - isometric
  - oblique (cabinet and cavalier)
  - perspective
  - dimensioning requirements and techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce freehand sketches to communicate or illustrate subject for further drafting work.
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<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• produce freehand orthogonal sketches and sectional views with information required to inform drawing work.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<p><b>Method of assessment</b></p>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can</p>

	<p>be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
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## Range Statement

<b>Key features</b>	<p>Key features may include:</p> <ul style="list-style-type: none"> <li>• shape</li> <li>• proposed subject</li> <li>• existing structures</li> <li>• services</li> <li>• dimensions</li> <li>• types of structure</li> <li>• shape of structure</li> <li>• type of construction</li> <li>• types of fasteners</li> <li>• layout</li> <li>• service requirements</li> <li>• location of plant and machinery</li> <li>• vertical and horizontal measurements</li> </ul>
<b>Orientation</b>	<p>Orientation may include:</p> <ul style="list-style-type: none"> <li>• relationship to the north compass point</li> <li>• location of other subjects</li> <li>• relationship to other subjects</li> </ul>
<b>Services</b>	<p>Services may include:</p> <ul style="list-style-type: none"> <li>• drainage</li> <li>• sewerage</li> <li>• gas</li> <li>• telephone and cable</li> <li>• water</li> <li>• electricity</li> <li>• air conditioning and ventilation</li> </ul>

	<ul style="list-style-type: none"> <li>• heating and cooling</li> </ul>
<b>Additional information</b>	<p>Additional information may include:</p> <ul style="list-style-type: none"> <li>• measurements and dimensions</li> <li>• design specifications</li> <li>• material</li> </ul>
<b>Drawing materials</b>	<p>Drawing materials may include:</p> <ul style="list-style-type: none"> <li>• pen and ink</li> <li>• graphite pencils</li> <li>• graph paper</li> <li>• cartridge paper</li> <li>• tracing paper</li> </ul>
<b>Standard drawing conventions</b>	<p>Standard drawing conventions may include:</p> <ul style="list-style-type: none"> <li>• use of correct sectioning technique</li> <li>• identification of cutting plane</li> <li>• accurate line types</li> <li>• appropriate view positions to the recognised drawing convention</li> <li>• use of correct symbols</li> <li>• use of correct dimensioning technique</li> <li>• provision of suitable number of views</li> <li>• use of correct proportions</li> <li>• neat presentation</li> </ul>
<b>Construction techniques</b>	<p>Construction techniques may include:</p> <ul style="list-style-type: none"> <li>• use of parallel lines</li> <li>• bisection of lines, angles and arcs</li> <li>• equal division of lines</li> <li>• construction of angles at 90, 45, 30, 60, 75 and 15 degrees</li> <li>• construction of a hexagon</li> <li>• sketching arcs tangential to two lines</li> <li>• sketching arcs tangential to two other arcs, internally and externally</li> <li>• sketching an arc tangential to a straight line and another arc</li> <li>• determining and indicating tangent points</li> </ul>
<b>Drawing techniques</b>	<p>Drawing techniques may include:</p> <ul style="list-style-type: none"> <li>• orthogonal projection:             <ul style="list-style-type: none"> <li>• first angle projection</li> <li>• third angle projection</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• projection symbol</li><li>• preferred system of projection in Australia</li><li>• number of views</li><li>• relationship of views</li><li>• sheet format:<ul style="list-style-type: none"><li>• borders and title blocks</li><li>• application of projection symbol</li><li>• drawing sheets and sizes</li><li>• lettering styles</li><li>• Australian standards</li></ul></li><li>• dimensioning:<ul style="list-style-type: none"><li>• unidirectional dimensioning</li><li>• aligned dimensioning</li><li>• projection and dimension lines</li><li>• arrow heads</li><li>• dimension placement</li></ul></li><li>• sectioning:<ul style="list-style-type: none"><li>• types of sections</li><li>• required section views</li><li>• placement of views</li><li>• cutting planes</li><li>• labelling of cutting planes and section views</li></ul></li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM09203A Measure and sketch site information

### Modification History

Release 1 - New unit of competency

### Unit Descriptor

This unit of competency covers the skills and knowledge required to take measurements and collect and record all relevant information from a site for the purpose of directing drafting work.

### Application of the Unit

This unit is suitable for those working within a computer-aided design (CAD) or drafting work environment. It includes preparation of a freehand sketch that details a range of relevant information to be used in detailed drawings or design work. It also covers taking accurate measurements using compass and straight edge and applying geometric construction methods.

If work requires entering a construction worksite, then the unit CPCOHS1001A Work safely in the construction industry should also be completed beforehand.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.



## Elements and Performance Criteria

1	Prepare for site visit	1.1	Verify and comply with applicable occupational health and safety (OHS), legislative and organisational requirements relevant to conducting site visits
		1.2	Confirm project brief and visit objectives, and review any available drawings and information on the project
		1.3	Arrange site visit and prepare required materials
		1.4	Check all measuring equipment and materials for sketching are available
2	Assess and record site features	2.1	Visually assess and record details on physical position, layout, access and location, and establish site references
		2.2	Visually assess and record details on site structure and materials
		2.3	Visually assess and record details on services
		2.4	Observe and record other details that may impact on project
		2.5	Obtain any relevant site information or documentation
3	Take site measurements	3.1	Take accurate measurements of site features as required by project brief
		3.2	Conduct calculations, as required, to ensure all required measurements are obtained and verified
		3.3	Access and use work information, technology and resources to complete work
		3.4	Minimise impact of work on the environment and ensure safety procedures are followed at all times
		3.5	Obtain or note missing measurements accordingly
4	Produce sketch of	4.1	Produce sketch to proportion

site	4.2	Apply correct sketching techniques and line construction to the sketch
	4.3	Apply all dimensions and notations
5	5.1	Sketch geometric shapes using correct construction techniques
	5.2	Obtain tangent points using correct techniques
	5.3	Apply line work using a range of different line types and media in accordance with standard industry drawing practice
6	6.1	Complete isometric sketches that illustrate site details
	6.2	Ensure all additional information gathered is documented appropriately to inform further work
	6.3	Ensure correct symbols and standard drawing conventions are adhered to
	6.4	Apply enterprise work procedures when conducting work and ensure quality standards are met

## Required Skills and Knowledge

### Required skills

Required skills include:

- sourcing and interpreting work-related information
- communicating verbally and in writing with team members and site/project managers
- interpreting diagrams and drawings
- taking accurate measurements
- using mathematical ideas and techniques to correctly complete measurements, calculate area, perimeter, volume, mass, scales and ratios
- using pre-checking techniques to anticipate measurement and drawing problems and avoid reworking
- using workplace technology related to measurement and drawing, including tools, equipment, calculators and measuring devices
- accurately calculating angles

- selecting principal axes and angles
- establishing positions of clear panels
- reading, interpreting and following information on work specifications, standard operating procedures, work instructions and other reference material
- maintaining accurate records
- carrying out work according to OHS practices
- completing industry standard freehand drawings and sketches

## Required knowledge

Required knowledge includes:

- relevant legislation
- OHS requirements for the engineering industry
- quality assurance procedures
- the theory and practice of calculations (addition, subtraction, multiplication and division)
- conventional signs and markings for plans and drawings
- the principles of plane geometry
- measurement techniques and equipment/tools

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to conduct an onsite visit and complete industry standard drawings, sketches and other documentation that includes measurements and all relevant site information to inform drafting work.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"><li>• work within typical site/teamwork structures and methods</li><li>• apply worksite communication procedures</li><li>• comply with organisational policies and</li></ul>

	<p>procedures, including quality requirements</p> <ul style="list-style-type: none"> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• take accurate site measurements and produce detailed sketch to inform detail drafting work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other relevant units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Required materials</b>	Required materials may include: <ul style="list-style-type: none"><li>• measuring equipment</li><li>• camera</li><li>• drawing paper, pencils and eraser</li><li>• compass</li><li>• straight edge</li><li>• chalk</li><li>• string</li></ul>
<b>Calculations</b>	Calculations may include: <ul style="list-style-type: none"><li>• area</li><li>• perimeter</li><li>• volume</li><li>• mass</li><li>• scales and ratios (ingredients/elements and triangulation) and addition</li><li>• subtraction</li><li>• multiplication and division processes</li></ul>
<b>Other details</b>	Other details may include: <ul style="list-style-type: none"><li>• vegetation</li><li>• surrounding objects or structures</li><li>• access for vehicles</li><li>• any other conditions which may impact on the project</li></ul>
<b>Standard drawing conventions</b>	Standard drawing conventions may include: <ul style="list-style-type: none"><li>• use of correct sectioning technique</li><li>• identification of cutting plane</li><li>• accurate line types</li><li>• appropriate view positions</li><li>• use of correct symbols</li><li>• use of correct dimensioning technique</li><li>• provision of suitable number of views</li><li>• use of correct scales</li><li>• neat presentation</li></ul>
<b>Drawing techniques</b>	Drawing techniques may include: <ul style="list-style-type: none"><li>• orthogonal projection:<ul style="list-style-type: none"><li>• first angle projection</li><li>• third angle projection</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• projection symbol</li> <li>• preferred system of projection in Australia</li> <li>• number of views</li> <li>• relationship of views</li> <li>• pictorial sketching: <ul style="list-style-type: none"> <li>• isometric</li> <li>• orthogonal (cabinet and cavalier)</li> <li>• pictorial</li> </ul> </li> <li>• sheet format: <ul style="list-style-type: none"> <li>• borders and title blocks</li> <li>• application of projection symbol</li> <li>• drawing sheets and sizes</li> <li>• lettering styles</li> <li>• Australian Standards</li> </ul> </li> <li>• dimensioning: <ul style="list-style-type: none"> <li>• unidirectional dimensioning</li> <li>• aligned dimensioning</li> <li>• projection and dimension lines</li> <li>• arrow heads</li> <li>• dimension placement</li> </ul> </li> <li>• sectioning: <ul style="list-style-type: none"> <li>• types of sections</li> <li>• required section views</li> <li>• placement of views</li> <li>• cutting planes</li> <li>• labelling of cutting planes and section views</li> </ul> </li> </ul>
<b>Drawing constructions</b>	<p>Drawing constructions may include:</p> <ul style="list-style-type: none"> <li>• isometric axes</li> <li>• isometric angles</li> <li>• isometric lines</li> <li>• non-isometric lines</li> <li>• isometric circles: <ul style="list-style-type: none"> <li>• four centre method</li> <li>• ordinate method</li> </ul> </li> <li>• sectioning isometric shapes</li> </ul>

## **Unit Sector(s)**

Drawing, drafting and design

## **Custom Content Section**

Not applicable.

## **MEM09204A Produce basic engineering detail drawings**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify drawing requirements, preparing engineering drawings and an engineering parts list, and issuing the drawings. Drawings include 2-D drawings to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment where most specifications required for the drawing are already determined. Specifications may be obtained from design information, customer requirements, sketches and preliminary layouts. Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to AS 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications.

If a CAD system is used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

This unit applies to all engineering and manufacturing environments.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B Interpret technical drawing

### **Employability Skills Information**

This unit contains employability skills



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Examine requirements for presentation of drawings
		1.5	Confirm communication requirements during project
2	Produce detail drawing	2.1	Prepare drawings in plane orthogonal, or equivalent
		2.2	Apply standard drawing conventions, including dimensions, required method of projection, and full notation
		2.3	Use drawing techniques according to work requirements
		2.4	Apply industry symbols and ensure presentation meets industry standard
3	Prepare engineering parts list	3.1	Identify components or parts and organise by component type and/or in accordance with organisation/customer requirements
		3.2	Prepare parts list in accordance with organisation/customer requirements

4	Complete drawing task	4.1	Check and confirm dimensions, angles and proportions
		4.2	Ensure drawing is presented according to organisational requirements and contains all relevant and accurate information
		4.3	Issue and file drawing according to workplace procedure
		4.4	Evaluate work and identify areas for improvement
		4.5	Plot or print the final drawing to a standard scale

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions and specifications for drawing work
- obtaining all relevant job requirements, data/information and specifications necessary to produce the drawing in accordance with workplace procedures
- planning and sequencing operations
- checking and clarifying task-related information
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- applying spatial principles to achieve scale and proportion
- using drafting equipment appropriate to the drawing method chosen
- recording completed drawings and/or parts lists in accordance with standard operating procedures
- handling and storing the approved drawings and/or parts lists in accordance with standard operating procedures

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and occupational health and safety (OHS) issues associated with the tools and materials used for drawing
- quality assurance procedures

- principles of plane geometry:
  - geometric shapes
  - plane geometry
  - geometric construction
  - line types during construction
- drawing construction:
  - four centre method
  - ordinate method
  - sectioning isometric shapes
  - dimensions and notations
- requirements and purpose of the drawing to be produced
- requirements and purpose of the engineering parts list
- sources of relevant data/information
- timeframe for completion of drawings
- persons who can confirm drawing requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use interpret and apply drawing specifications, and produce a complete drawing to AS 1100.101–1992 Technical drawing – General principles, using manual or CAD tools.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> </ul>

	<ul style="list-style-type: none"> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• interpret work and design specifications and use reference material to obtain required information for drawing work</li> <li>• produce a detailed engineering drawing to AS 1100.101–1992 Technical drawing – General principles, and according to work requirements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards,</p>

	manuals and reference materials.
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## Range Statement

<b>Standard drawing conventions</b>	<p>Standard drawing conventions include:</p> <ul style="list-style-type: none"> <li>• use of correct sectioning technique</li> <li>• identification of cutting plane</li> <li>• accurate line types</li> <li>• appropriate view positions</li> <li>• use of correct symbols</li> <li>• use of correct dimensioning technique</li> <li>• provision of suitable number of views</li> <li>• use of correct scales</li> <li>• neat presentation</li> </ul>
<b>Drawing techniques</b>	<p>Drawing techniques may include:</p> <ul style="list-style-type: none"> <li>• orthogonal projection: <ul style="list-style-type: none"> <li>• first angle projection</li> <li>• third angle projection</li> <li>• projection symbol</li> <li>• preferred system of projection in Australia</li> <li>• number of views</li> <li>• relationship of views</li> </ul> </li> <li>• sheet format: <ul style="list-style-type: none"> <li>• borders and title blocks</li> <li>• application of projection symbol</li> <li>• drawing sheets and sizes</li> <li>• lettering styles</li> <li>• Australian Standards</li> </ul> </li> <li>• dimensioning: <ul style="list-style-type: none"> <li>• unidirectional dimensioning</li> <li>• aligned dimensioning</li> <li>• projection and dimension lines</li> <li>• arrow heads</li> <li>• dimension placement</li> </ul> </li> <li>• scale drawing: <ul style="list-style-type: none"> <li>• recommended scales</li> <li>• reduction scales</li> <li>• enlargement scales</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• multiple scales</li><li>• dimensioning techniques of scale drawings</li><li>• sectioning:<ul style="list-style-type: none"><li>• types of sections</li><li>• required section views</li><li>• placement of views</li><li>• cutting planes</li><li>• labelling of cutting planes and section views</li></ul></li><li>• general notes</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# MEM09205A Produce electrical schematic drawings

## Modification History

Release 1 - New unit of competency

## Unit Descriptor

This unit of competency covers the skills and knowledge required to produce electrical schematic drawings to comply with Australian Standard (AS) 1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or equivalent, using predetermined design specifications. The unit also covers the production of layout or block diagrams to show the physical arrangement of components.

## Application of the Unit

This unit is suitable for those working within a drafting work environment. The unit applies to the production of schematic drawings to show electrical circuits and connections between devices, including power and signal connections. It includes the use of appropriate symbols and production of a matching reference list of circuit components. Types of electrical drawings or diagrams may include block, single line, interconnecting, wiring, circuit, telephonic and telegraphic or cable form diagrams, and notations.

Drawings may be carried out with or without the use of computer-aided design (CAD) systems and are completed to AS 1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or equivalent.

If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

Drawings are completed under supervision.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine schematic drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and access organisational files, templates and symbols as required for work
2	Identify system requirements	2.1	Identify and apply relevant codes, standards and symbols used for electrical diagrams and drawings
		2.2	Identify function and purpose of circuit and its components and assemblies
		2.3	Identify environmental implications of inefficient systems and strategies for minimising impact
3	Prepare electrical drawings and diagrams	3.1	Lay out drawing in accordance with the sketches and specifications
		3.2	Prepare an electrical block diagram in accordance with Australian Standards



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|---|--|-----|--|
|   |  | 3.3 | Draw cable run and riser diagrams from schedules   |
|   |  | 3.4 | Produce switchboard layout drawings  |
|   |  | 3.5 | Prepare single line and interconnecting electrical diagrams in accordance with Australian Standards  |
|   |  | 3.6 | Prepare wiring and circuit diagrams in accordance with Australian Standards  |
|   |  | 3.7 | Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information, including correct line work, scales, notation and dimensioning |
|   |  | 3.8 | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Prepare materials list                       | 4.1 | Where required, select components and/or materials from supplier/manufacturer catalogues using predetermined specifications  |
|   |  | 4.2 | Produce a parts list in accordance with workplace procedures   |
|   |  | 4.3 | Store drawings and/or materials list according to workplace procedures   |
| 5 | Consult appropriately with other disciplines | 5.1 | Verify the parameters of the brief and clarify specifications with appropriate personnel   |
|   |  | 5.2 | Identify and consult with support services   |
|   |  | 5.3 | Present and explain drawings at appropriate stages of the project  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and

specifications for drawings work

- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- drafting skills
- applying symbols, schedules and legends to the drawing
- arranging the views in a logical manner and in accordance with AS 1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or equivalent
- correctly using line thickness and construction to identify parts
- using engineering and manufacturer catalogues, tables, standards and specifications
- drawing electrical/electronic schematics correctly and indicating the relative position of the components
- producing electrical/electronic drawings with all relevant specifications
- obtaining the circuit/component specifications
- planning and sequencing operations
- checking and clarifying task related information
- filing drawings according to workplace procedures

## Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- requirements of AS 1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or equivalent with respect to electrical/electronic schematics/drawings
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- company standards for CAD
- order of drawing process
- company checking procedures for drawings
- layout and presentation
- the standards applicable to the work to be undertaken
- the process of checking the completed drawing
- the process of storing paper drawings and electronic drawing files
- the International System of Units (SI)
- terminology associated with the preparation of electrical diagrams and drawings

- basic components used in electrical installations
- wiring types used in electrical installations
- functions of components, such as:
  - resistors
  - capacitors

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications in the production of electrical diagrams and drawings to Australian Standard AS1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or equivalent.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• obtain required information for work and produce detailed electrical/electronic schematic drawings in accordance with AS1102.101–1989 Graphical symbols for electrotechnical documentation – General information and general index, or similar.</li> </ul>
<b>Context of and specific resources</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where

<b>for assessment</b>	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• catalogues and manuals</li> <li>• design brief</li> </ul>
<b>Components and assemblies</b>	<p>Components and assemblies may include:</p> <ul style="list-style-type: none"> <li>• resistors: fixed (composition and wire wound), variable (rheostats, potentiometers and trimmers), and non-linear (thermistors)</li> <li>• capacitors: fixed (ceramic, plastic and electrolytic), variable, magnetic, transformers, chokes, relays, contactors, rectifiers, smoothing filters, voltage regulators and feedback</li> </ul>
<b>Electrical layouts</b>	<p>Electrical layouts may include:</p> <ul style="list-style-type: none"> <li>• domestic lighting</li> <li>• domestic power</li> <li>• commercial</li> <li>• lighting schedule</li> <li>• power schedule</li> <li>• factory electrification</li> <li>• flame proofing</li> <li>• buzz bar systems</li> <li>• 3 phase</li> <li>• 240 V and 415 V</li> </ul>
<b>Cable runs</b>	<p>Cable runs may include:</p> <ul style="list-style-type: none"> <li>• racking</li> <li>• schedules</li> </ul>
<b>Riser diagrams</b>	<p>Riser diagrams may include:</p> <ul style="list-style-type: none"> <li>• multi-storey</li> </ul>
<b>Switchboards</b>	<p>Switchboards may include:</p> <ul style="list-style-type: none"> <li>• layouts</li> <li>• wiring schedules</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• designer</li> </ul>

	<ul style="list-style-type: none"><li>• engineer</li><li>• supervisor</li><li>• contractor/consultant</li><li>• builder</li></ul>
<b>Support services</b>	Support services may include: <ul style="list-style-type: none"><li>• estimating department and personnel</li><li>• engineering department and personnel</li><li>• drafting department and personnel</li><li>• project manager</li><li>• factory manager or staff</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# MEM09206A Produce drawings for mechanical services

## Modification History

Release 1 - New unit of competency

## Unit Descriptor

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings for the installation of heating, ventilation, air conditioning and refrigeration (HVAC/R) systems within the mechanical services industry.

## Application of the Unit

This unit is suitable for those working within a drafting work environment in the mechanical services industry. Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a      Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and apply relevant codes, standards and symbols used in the mechanical services industry for installation drawings
		1.5	Identify and access organisational files, templates and symbols as required for work
		1.6	Identify environmental implications of inefficient systems and strategies for minimising impact
2	Identify HVAC/R measuring and control devices	2.1	Identify features and uses of temperature and pressure measurement devices
		2.2	Identify features and uses of air and fluid measurement instruments
		2.3	Identify features and uses of standard control devices and measurement devices
		2.4	Identify location of control and measurement devices on drawings
3	Produce drawings for installation of heating and cooling systems	3.1	Apply operating principles and specifications of heating and cooling systems and equipment to drawing work
		3.2	Complete drawing according to mechanical services industry standard for heating and cooling systems



- |   |   |     |  |
|---|---|-----|--|
|   |   | 3.3 | Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information |
|   |   | 3.4 | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Produce drawings for installation of air conditioning and exhaust systems | 4.1 | Apply operating principles and specifications of a range of air conditioning systems and equipment to drawing work                             |
|   |   | 4.2 | Apply operating principles and specifications of a range of exhaust systems to drawing work  |
|   |   | 4.3 | Complete drawing according to mechanical services industry standard for air conditioning systems   |
|   |   | 4.4 | Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information |
|   |   | 4.5 | Evaluate drawing for system efficiency and make or report potential improvements   |
| 5 | Produce drawings for installation of refrigeration systems                | 5.1 | Apply operating principles and specifications of a range of refrigeration systems and equipment to drawing work                                |
|   |   | 5.2 | Complete drawing according to mechanical services industry standard for refrigeration systems  |
|   |   | 5.3 | Ensure drawing is presented according to organisational requirements and contains all relevant information                                     |
|   |   | 5.4 | Evaluate drawing for system efficiency and make or report potential improvements   |
| 6 | Consult appropriately with other disciplines                              | 6.1 | Verify the parameters of the brief and clarify specifications with appropriate personnel   |
|   |   | 6.2 | Identify and consult with support services   |
|   |   | 6.3 | Present and explain drawings at appropriate stages of the project  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- interpersonal skills to consult with other disciplines
- applying drafting skills, drawing techniques and conventions
- applying codes, symbols and drawing protocols for mechanical services drawings
- applying spatial principles to achieve scale and proportion
- determining and applying operating principles of system equipment to drawing work
- solving problems in order to meet requirements of given specifications
- using drafting equipment appropriate to the drawing method chosen
- recording completed drawings in accordance with industry standards and practices
- handling and storing the approved drawings in accordance with standard operating procedures
- preparing drawing presentation in a manner that makes information accessible and complete
- filing drawings according to workplace procedures
- evaluating work and identifying areas for improvement

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- company standards for CAD, duct and pipe
- order of drawing process
- company checking procedures for drawings
- layout and presentation
- operating principles of pressure and temperature measurement devices
- operating principles of heating and cooling system equipment
- operating principles of air conditioning equipment

- operating principles of exhaust systems
- operating principles of refrigeration equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of installation drawings for the mechanical services industry.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• demonstrate industry knowledge, including: <ul style="list-style-type: none"> <li>• industry size, scope of work and economic issues</li> <li>• relevant industrial awards and enterprise agreements</li> <li>• relevant legislative provisions covering discrimination and equal employment opportunity</li> </ul> </li> <li>• identify features and uses of componentry and system elements for mechanical services and requirements for documenting on detail drawings</li> <li>• produce industry standard detail drawings for</li> </ul>

	mechanical services industry.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• floor plans, elevations, sections and site layout</li> </ul>
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	<p>drawings</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
<b>Industry standards</b>	<p>Industry standards may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Building Codes of Australia (BSA)</li> <li>• Australian Standards (AS)</li> <li>• legislation requirements from Building Practitioner's Board (RBP)</li> <li>• Australian Gas Codes (AGC)</li> <li>• Sheet Metal and Air Conditioning Contractors National Association (SMACNA)</li> <li>• third-party manufacturing and installation standards</li> <li>• company standards</li> <li>• guidelines</li> <li>• general practices</li> </ul>
<b>Codes, standards and industry regulations</b>	<p>Codes, standards and industry regulations may include:</p> <ul style="list-style-type: none"> <li>• AS/NZS 1668 Set:2005 The use of ventilation and air conditioning in building Set</li> <li>• AS 1682.1–1990 Fire dampers – Specification</li> <li>• AS 4254–2002 Ductwork for air-handling systems in buildings</li> <li>• building codes</li> <li>• gas, water and electricity regulations</li> <li>• OHS codes of practice</li> </ul>
<b>Heating and cooling systems and equipment</b>	<p>Heating and cooling systems and equipment may include:</p> <ul style="list-style-type: none"> <li>• boilers</li> <li>• clarifiers</li> <li>• heat exchanges</li> <li>• coils</li> <li>• centrifugal chillers</li> <li>• cooling towers</li> <li>• pumps</li> <li>• valves</li> <li>• auto refill units</li> </ul>

	<ul style="list-style-type: none"> <li>• expansion tanks</li> <li>• pipe work systems</li> </ul>
<b>Pressure and temperature measurement devices</b>	<p>Pressure and temperature measurement devices may include:</p> <ul style="list-style-type: none"> <li>• humidistat</li> <li>• thermostat</li> </ul>
<b>Air conditioning equipment</b>	<p>Air conditioning equipment may include:</p> <ul style="list-style-type: none"> <li>• fans</li> <li>• air filtration units</li> <li>• heating systems</li> <li>• cooling systems</li> <li>• ducts, grilles</li> <li>• diverters</li> <li>• diffusers</li> <li>• dampers</li> <li>• humidifier/dehumidifier</li> <li>• exhaust hoods</li> </ul>
<b>Exhaust systems</b>	<p>Exhaust systems may include:</p> <ul style="list-style-type: none"> <li>• kitchen</li> <li>• fume</li> <li>• dust</li> <li>• smoke</li> <li>• toilet and car park systems</li> </ul>
<b>Refrigeration equipment</b>	<p>Refrigeration equipment may include:</p> <ul style="list-style-type: none"> <li>• refrigeration compressors</li> <li>• condensers</li> <li>• evaporative condensers</li> <li>• pumps</li> </ul>
<b>Standard drawing conventions</b>	<p>Standard drawing conventions may include:</p> <ul style="list-style-type: none"> <li>• use of correct sectioning technique</li> <li>• identification of cutting plane</li> <li>• accurate line types</li> <li>• appropriate view positions</li> <li>• use of correct symbols</li> <li>• use of correct dimensioning technique</li> <li>• provision of suitable number of views</li> <li>• use of correct scales</li> <li>• neat presentation</li> </ul>

<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• designer</li><li>• engineer</li><li>• supervisor</li><li>• contractor/consultant</li><li>• builder</li></ul>
<b>Support services</b>	Support services may include: <ul style="list-style-type: none"><li>• estimating department and personnel</li><li>• engineering department and personnel</li><li>• drafting department and personnel</li><li>• project manager</li><li>• factory manager or staff</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09207A Produce drawings for reticulated services**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings for the installation of reticulated services such as water, gas, refrigeration, steam, compressed air and other services requiring reticulated pipework, flues or ducts in commercial and industrial buildings. Drawings are completed to relevant Australian Standards.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment in the air conditioning and mechanical services industry.

Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings

### **Employability Skills Information**

This unit contains employability skills



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and access organisational files, templates and symbols as required for work
2	Identify working principles for reticulated systems	2.1	Identify principles of reticulation and application in service system
		2.2	Identify the operational features of hot and cold water systems and suitability for specific applications
		2.3	Distinguish between the operation of a condenser, chilled, heating, compressed air systems and water systems, and confirm suitability for specific applications
		2.4	Identify operational features and ventilation requirements for different gas systems
		2.5	Identify safety and environmental implications of reticulated system
3	Produce drawings for reticulated systems	3.1	Lay out drawing in accordance with the sketches and supplied specifications
		3.2	Identify different parts of services on drawings

- 3.3 Size the system in accordance with relevant standards, regulations and workplace requirements
- 3.4 Apply knowledge of working principles of reticulated system to drawing
- 3.5 Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information, including full notation and dimensioning
- 3.6 Apply workplace occupational health and safety (OHS) and environmental procedures
- 3.7 Identify and apply relevant codes, standards and symbols used for reticulated services installation drawings

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with others, as required, to gain information required
- drafting skills
- applying the correct line thicknesses and construction types to distinguish between building's elements and systems
- applying symbols, schedules and legends used in the mechanical services industry to the drawing
- confirming selection of components with design specifications
- applying operational principles of reticulated services to drawing work
- arranging the views in a logical manner and in accordance with AS 1100.101–1992 Technical drawing – General principles
- correctly using line thickness and construction to identify parts
- using engineering and manufacturer catalogues, tables, standards and specifications
- filing drawings according to workplace procedures

## Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- company standards for CAD
- order of drawing process
- company checking procedures for drawings
- layout and presentation
- the relevant statutory and authority requirements related to reticulation systems
- terminology associated with drawings
- the process of checking the completed drawing
- the process of storing paper drawings and electronic drawing files
- principles of steam reticulation
- principles of reticulation
- features and operating principles of a reticulation systems and components
- flue requirements in an liquefied petroleum gas (LPG) system
- issues and hazards of fuel storage
- expansion and contraction factors
- support systems/anchors used in reticulated systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of drawings for the installation of reticulated services.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and

	<p>contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• produce drawings for reticulated services to industry standard.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of</p>

	competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
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## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
<b>Reticulated systems</b>	<p>Reticulated systems may include:</p> <ul style="list-style-type: none"> <li>• hot and cold water systems</li> <li>• steam and condensate systems</li> <li>• heating/chilled and condenser water systems</li> <li>• compressed air systems</li> <li>• natural and LPG systems</li> <li>• pipe work insulation</li> <li>• flues and insulation</li> </ul>
<b>Operational features and working principles of reticulated system components</b>	<p>Operational features and working principles of reticulated system components include:</p> <ul style="list-style-type: none"> <li>• variable refrigerant volume (VRV) systems</li> <li>• refrigeration systems</li> <li>• slab heating/cooling</li> <li>• hydronic heating</li> <li>• chilled beams</li> <li>• medical gases</li> <li>• fittings/valve types: <ul style="list-style-type: none"> <li>• strainer</li> <li>• balancing</li> <li>• isolating</li> <li>• non-return</li> <li>• pumps</li> </ul> </li> <li>• air side:</li> </ul>

	<ul style="list-style-type: none"> <li>• fans</li> <li>• dampers</li> <li>• registers</li> <li>• filters</li> <li>• air handling units</li> <li>• vav units</li> <li>• domestic hot and cold water systems</li> <li>• steam and condensate systems</li> <li>• heating/chilled and condenser water systems</li> <li>• compressed air systems</li> <li>• gas systems</li> <li>• insulation</li> </ul>
<b>Codes, standards and industry regulations</b>	<p>Safety standards include:</p> <ul style="list-style-type: none"> <li>• AS/NZS 1668 Set:2005 The use of ventilation and air conditioning in building Set</li> <li>• AS 1682.1–1990 Fire dampers – Specification</li> <li>• AS 4254–2002 Ductwork for air-handling systems in buildings</li> <li>• building codes</li> <li>• OHS codes of practice</li> <li>• Gas Regulations overview</li> </ul>
<b>Industry standards</b>	<p>Industry standards may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Building Codes of Australia (BSA)</li> <li>• Australian Standards (AS)</li> <li>• legislation requirements from Building Practitioner's Board (RBP)</li> <li>• Australian Gas Codes (AGC)</li> <li>• Sheet Metal and Air Conditioning Contractors National Association (SMACNA)</li> <li>• third-party manufacturing and installation standards</li> <li>• company standards</li> <li>• guidelines</li> <li>• general practices</li> </ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# MEM09208A Detail fasteners and locking devices in mechanical drawings

## Modification History

Release 1 - New unit of competency

## Unit Descriptor

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings containing fastening and locking devices.

## Application of the Unit

This unit is suitable for those working within a drafting work environment and can be applied across all engineering disciplines. Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications.

If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM09002B Interpret technical drawing

MEM09204A Produce basic engineering detail drawings

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Elements describe the      Performance criteria describe the performance needed to



essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and access organisational files, templates and symbols as required for work
2	Identify system requirements	2.1	Access catalogues, tables, standards and specifications to determine required components
		2.2	Identify types of fasteners, their features, uses and thread types
		2.3	Identify mechanical location and locking devices, their features, uses and thread types
		2.4	Identify and apply relevant codes, standards and symbols used for components and methods used to locate on drawings
3	Prepare detail drawing	3.1	Lay out drawing in accordance with the sketches and specifications
		3.2	Apply line work using a range of different line types and media in accordance with standard industry drawing practice
		3.3	Produce detail and assembly drawings containing engineering fasteners and location devices
		3.4	Ensure drawing accurately reflects specifications, is

presented according to organisational requirements and contains all relevant information, including full notation and dimensioning

- |   |                             |     |  |
|---|-----------------------------|-----|--|
|   |                             | 3.5 | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Document and store drawings | 4.1 | Document drawings and associated technical information in accordance with project requirements and organisational procedures |
|   |                             | 4.2 | Store drawings according to organisational procedures  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- drafting skills
- applying symbols, schedules and legends to the drawing
- arranging the views in a logical manner and in accordance with AS 1100.101–1992 Technical drawing – General principles
- correctly using line thickness and construction to identify parts
- using correct method for identifying thread forms on detail and assembly drawings
- using engineering and manufacturer catalogues, tables, standards and specifications
- filing drawings according to workplace procedures

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing

- quality assurance procedures
- company standards for CAD
- order of drawing process
- company checking procedures for drawings
- layout and presentation
- the standards applicable to the work to be undertaken
- the process of checking the completed drawing
- the process of storing paper drawings and electronic drawing files
- the International System of Units (SI)
- the different types of fasteners used in the manufacture of an engineering project
- lubrication components and systems and lubricants
- terminology associated with the preparation of mechanical drawings
- different types of thread forms, types and sizes
- types of nuts and uses for locking purposes
- manufacturing processes required to create a drilled and tapped hole and a threaded feature
- grades of bolts and their applications

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of mechanical drawings which detail fasteners and locking devices.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> </ul>

	<ul style="list-style-type: none"><li>• participate in work meetings</li><li>• comply with quality requirements</li><li>• use industry terminology</li><li>• apply appropriate safety procedures</li><li>• produce drawings to AS 1100.101–1992</li></ul> Technical drawing – General principles, detailing fasteners and locking devices.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"><li>• construction documents</li><li>• building and coordination information</li><li>• work specifications</li><li>• information for plant services equipment</li><li>• industry codes, standards and regulations</li><li>• design brief</li></ul>
<b>Fasteners</b>	<p>Fasteners may include:</p> <ul style="list-style-type: none"><li>• any mechanical device for joining or affixing two or more components together, such as:<ul style="list-style-type: none"><li>• bolts, machine screws, screws, nuts, washers, rivets, locating devices, circlips and masonry anchors</li></ul></li><li>• threaded fastening devices:<ul style="list-style-type: none"><li>• bolts</li><li>• hex head</li><li>• square head</li><li>• carriage</li><li>• countersunk square neck</li></ul></li><li>• machine screws:<ul style="list-style-type: none"><li>• square head</li><li>• hex. head</li><li>• round head</li><li>• countersunk head</li><li>• cheese head</li><li>• pan head</li><li>• raised head countersunk</li></ul></li><li>• set screws:<ul style="list-style-type: none"><li>• square head</li><li>• hex. socket</li><li>• spline socket</li><li>• slotted (screwdriver)</li></ul></li><li>• studs</li><li>• self tapping screws</li><li>• drive screws</li><li>• cap screws:<ul style="list-style-type: none"><li>• hex. socket</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• spline socket</li> <li>• hex. socket countersunk</li> <li>• nuts</li> <li>• square</li> <li>• hex</li> <li>• slotted</li> <li>• castle</li> <li>• cap or acorn</li> <li>• wing</li> <li>• ring</li> <li>• thread types (metric - imperial)</li> <li>• sizes</li> <li>• grades</li> <li>• thread forms: <ul style="list-style-type: none"> <li>• vee</li> <li>• square</li> <li>• acme</li> <li>• buttress</li> <li>• round</li> </ul> </li> <li>• rivets: <ul style="list-style-type: none"> <li>• button head</li> <li>• high button</li> <li>• cone head</li> <li>• pan head</li> <li>• flat-top countersunk head</li> <li>• round-top countersunk head</li> <li>• swell neck</li> <li>• pop rivets</li> <li>• huck bolts</li> </ul> </li> <li>• cotter pins (split pins)</li> <li>• circlips: <ul style="list-style-type: none"> <li>• internal</li> <li>• external</li> <li>• round</li> <li>• snap</li> </ul> </li> <li>• masonry anchors: <ul style="list-style-type: none"> <li>• loxin</li> <li>• dynabolt</li> <li>• ramset</li> </ul> </li> </ul>
<b>Mechanical location devices</b>	Mechanical location devices may include:

	<ul style="list-style-type: none"> <li>pins: <ul style="list-style-type: none"> <li>dowel pins</li> <li>taper pins</li> <li>split taper pins</li> <li>split pins (roll pin)</li> <li>grooved pins</li> </ul> </li> <li>keys and keyseats: <ul style="list-style-type: none"> <li>parallel</li> <li>plain taper</li> <li>gibhead taper</li> <li>feather</li> <li>saddle</li> <li>round</li> <li>scotch</li> <li>woodruff (full radius/flat bottom)</li> </ul> </li> </ul>
<b>Locking devices</b>	<p>Locking devices may include:</p> <ul style="list-style-type: none"> <li>lock nuts (double nuts)</li> <li>nyloc nuts</li> <li>split nuts</li> <li>deformed</li> <li>washers: <ul style="list-style-type: none"> <li>plain washers</li> <li>tab washers</li> <li>tapered washers</li> <li>internal tooth lockwashers</li> <li>external tooth lockwashers</li> <li>internal and external lockwashers</li> <li>split spring washers</li> <li>double coil spring washers</li> </ul> </li> <li>wiring</li> <li>chemical methods of thread locking</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>designer</li> <li>engineer</li> <li>supervisor</li> <li>contractor/consultant</li> <li>builder</li> </ul>
<b>Support services</b>	<p>Support services may include:</p>

	<ul style="list-style-type: none"><li>• estimating department and personnel</li><li>• engineering department and personnel</li><li>• drafting department and personnel</li><li>• project manager</li><li>• factory manager or staff</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.



## **MEM09209A Detail bearings, seals and other componentry in mechanical drawings**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings containing bearings and mechanical seals, engineering keys and keyways, holes and shafts to provide specific clearances by applying general tolerances, and confirming the geometric shape of components by applying geometric tolerances.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment and can be applied across all engineering disciplines. Drawings may be carried out with or without the use of computer-aided design (CAD) systems and are completed to Australian Standard (AS) 1100.1–1992 Technical drawing – General principles.

If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

Drawings are completed under supervision.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B	Interpret technical drawing
MEM09204A	Prepare basic engineering detail drawings

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing requirements	1.1	Check purpose, scope and information requirements for drawing
		1.2	Interpret available information relevant to project and work requirements and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and access organisational files, templates and symbols as required for work
2	Identify system requirements	2.1	Access catalogues, tables, standards and specifications to determine required components
		2.2	Identify types of bearings, their features and uses
		2.3	Identify types of mechanical seals, their features and uses
		2.4	Determine method of general tolerancing, classes of fit and forms of geometric shapes from engineer, sketches or specifications
		2.4	Determine other componentry and type of lubricants to be used
		2.6	Identify and apply relevant codes, standards and symbols used for components and methods used to locate on drawings
3	Prepare detail drawing	3.1	Lay out drawing in accordance with the sketches and specifications

- |   |                             |  |
|---|-----------------------------|--|
|   | 3.2                         | Apply line work using a range of different line types and media in accordance with standard industry drawing practice  |
|   | 3.3                         | Produce detail and assembly drawings containing engineering bearings and mechanical seals, applying general tolerances, where required   |
|   | 3.4                         | Produce detail drawings requiring sizing and tolerancing of keys and keyways   |
|   | 3.5                         | Produce detail drawings containing shafts and holes and fully tolerance to suit a particular Class of Fit  |
|   | 3.6                         | Produce detail drawings of engineering components applying geometric tolerances to the shape   |
|   | 3.7                         | Apply surface texture finishes to detail drawings  |
|   | 3.8                         | Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information, including full notation and dimensioning |
|   | 3.5                         | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Document and store drawings |  |
|   | 4.1                         | Document drawings and associated technical information in accordance with project requirements and organisational procedures   |
|   | 4.2                         | Store drawings according to organisational procedures  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawings work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit

- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- drafting skills
- applying symbols, schedules and legends to the drawing
- arranging the views in a logical manner and in accordance with AS 1100.1–1992  
Technical drawing – General principles
- correctly using line thickness and construction to identify parts
- using engineering and manufacturer catalogues, tables, standards and specifications
- applying surface texture symbols to comply to engineer's requirements
- applying toleranced dimensions to a detail drawing
- reading and selecting the correct key, keyway and keyseat sizes given a specified condition using the appropriate tables
- reading and selecting correct toleranced dimensions to meet the required Class of Fit as selected by the engineer or from the specifications
- selecting a bearing or seal from engineering and manufacturer catalogues, tables, standards and specifications to fit into housings and over shafts
- converting between unilateral, bilateral and limit of size or direct tolerances
- applying tolerances to meet the individual fit classifications between a shaft and hole (clearance, interference and transition)
- filing drawings according to workplace procedures

## Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- company standards for CAD
- order of drawing process
- company checking procedures for drawings
- layout and presentation
- the standards applicable to the work to be undertaken
- the process of checking the completed drawing
- the process of storing paper drawings and electronic drawing files
- the International System of Units (SI)
- the different types of bearings used in the manufacture of an engineering project
- the different types of seals used in the manufacture of an engineering project
- surface texture finishes and machining processes
- geometric tolerances with regard to the roundness, straightness, flatness, concentricity,

and so on, of an engineering component

- terminology associated with the preparation of mechanical drawings

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of mechanical drawings which detail bearings seals and other componentry.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• demonstrate industry knowledge, including: <ul style="list-style-type: none"> <li>• industry size, scope of work and economic issues</li> <li>• relevant industrial awards and enterprise agreements</li> <li>• relevant legislative provisions covering discrimination and equal employment opportunity.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate

	<p>simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• assembly and installation drawings</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
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<b>Bearings</b>	<p>Bearings may include:</p> <ul style="list-style-type: none"> <li>• plain and anti-friction bearings, including ball, roller, angle, self-aligning, thrust and taper bearings</li> </ul>
<b>Seals</b>	<p>Seals may include:</p> <ul style="list-style-type: none"> <li>• all devices designed to prevent the movement of fluid from one area to another, or to exclude contaminants, such as: <ul style="list-style-type: none"> <li>• static and dynamic seals, including wiper, rod, piston, guide and V-packing O-rings</li> </ul> </li> </ul>
<b>General tolerances</b>	<p>General tolerances may include:</p> <ul style="list-style-type: none"> <li>• unilateral</li> <li>• bilateral</li> <li>• limits of size or direct</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• designer</li> <li>• engineer</li> <li>• supervisor</li> <li>• contractor/consultant</li> <li>• builder</li> </ul>
<b>Support services</b>	<p>Support services may include:</p> <ul style="list-style-type: none"> <li>• estimating department and personnel</li> <li>• engineering department and personnel</li> <li>• drafting department and personnel</li> <li>• project manager</li> <li>• factory manager or staff</li> </ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09210A Create 3-D solid models using computer-aided design (CAD) system**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit covers preparing the 3-D computer-aided drafting (CAD) environment, creating and modifying 3-D solid models, and producing output from the 3-D model.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment and may be applied across a range of engineering disciplines. This unit applies to the production of 3-D solid models using CAD modelling software. Operations at this level include, but are not limited to, the creation and manipulation of entities, such as arcs, lines and primitives, such as spheres, cones, cylinders and boxes. It includes the use of region and solid modelling techniques, section views, and pre-drawn library files. Work also includes extraction of properties and application of basic rendering techniques.

This unit includes applications in CAD, computer graphics and animation, rapid prototyping, medical testing and visualisation of scientific research.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B Interpret technical drawing

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine solid modelling requirements	1.1	Check purpose, scope and information requirements for modelling task
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and apply relevant codes, standards and symbols relevant to work
		1.5	Consult appropriate personnel to ensure the work is coordinated effectively with others involved in the project
		1.6	Obtain and apply workplace occupational health and safety (OHS) and environmental procedures for work
2	Prepare 3-D environment	2.1	Apply workplace procedures to retrieve and manipulate required information and navigate computing technology
		2.2	Set up a 3-D environment on the screen to allow multiple viewing
		2.3	Create 3-D views on the screen by manipulating drawing planes and inserting 3-D geometric shapes
		2.4	Establish coordinate system and orientation according to job requirements
		2.5	Determine and exploit key features of solid modelling software package

3	Produce output from 3-D model	3.1	Perform drawing for solid modelling
		3.2	Exploit features of modelling software to optimise productivity
		3.3	Extract physical properties to job requirement, including volume, mass and centre of gravity
		3.4	Apply rendering techniques
		3.5	Produce 3-D drawings incorporating section views with all necessary annotation
4	Complete CAD operations	4.1	Confirm model accurately reflects specifications, is presented according to work requirements and contains all relevant information
		4.2	Save and file drawing elements according to organisational procedure
		4.3	Evaluate work and identify areas for improvement
		4.4	Close applications, perform CAD housekeeping and maintain organisational filing system

## Required Skills and Knowledge

### Required skills

Required skills include:

- using computing technologies and navigating software
- obtaining relevant job instructions and specifications
- creating the appropriate entities in 3-D space
- manipulating the entities in 3-D space
- creating swept, extruded and revolved solids in 3-D space
- modifying, where appropriate, existing 3-D models
- saving drawing files in the appropriate format
- extracting the physical properties of shapes created in 3-D space from the drawing file to meet job requirements
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable

reference documents

- checking and clarifying task-related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- creating intelligent models using parametric modelling
- producing composite models (composite regions and composite solids)
- producing sectioned models (cutting planes and cross hatching)
- using pre-drawn library files and primitives to produce a 3-D model
- extracting mass and area properties from solid model
- applying rendering techniques to a 3D model (rendering types and preferences, render lighting techniques, and views and scenes)
- using various materials and surface finish options
- producing hard copies of 3-D solid models
- saving 3-D models in various file formats for retrieval into other CAD application software
- producing orthogonal detail drawings of components on standard drawing sheets to a recognised drafting scale

## Required knowledge

Required knowledge includes:

- purpose for which the 3-D model is to be developed
- appropriate coordinate system for the job
- reasons for selecting the chosen coordinate system
- orientation of the model with respect to the coordinate system
- number of views required to establish the model
- procedures for creating entities in 3-D space
- the entities that can be created/manipulated in 3-D space
- procedures for manipulating entities in 3-D space
- procedures for creating swept, extruded and revolved solids in 3-D space
- applications of swept, extruded and revolved solids
- procedures for modifying existing 3-D models
- rendering types and preferences, render lighting techniques, views and scenes
- procedures for saving drawing files
- the various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures for extracting data with respect to the physical properties of shapes created in 3-D space
- the physical properties of shapes created in 3-D space that can be extracted from the drawing file
- hazard and control measures associated with using CAD system, including housekeeping
- safe work practices and procedures
- terminology associated with solid modelling (region modelling, solid modelling, and

wire frame, as opposed to solids)

- region modelling techniques (creating a region primitive and editing regions)
- solid modelling techniques (creating solid primitives, editing solid primitives, and conversion from region to solid models)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to create 3-D models using CAD systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• select and use 3-D CAD software to create solid models that meet design specifications.</li> </ul>
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 3-D models using CAD systems or other units requiring the exercise of the skills and knowledge covered by this unit
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

## Range Statement

<b>Solid modelling task</b>	<p>Solid modelling task may include:</p> <ul style="list-style-type: none"> <li>• terminology</li> <li>• region modelling</li> <li>• solid modelling</li> <li>• parametric modelling</li> <li>• composite models</li> <li>• section models</li> <li>• library files and 3-D primitives</li> <li>• other relevant software packages for the production of 3-D models</li> <li>• mass and area properties</li> <li>• rendering techniques</li> <li>• material finishes</li> <li>• production of hard copies</li> <li>• saving and retrieval of files of varying formats</li> <li>• consolidation (e.g. project work)</li> </ul>
<b>Rendering techniques</b>	<p>Rendering techniques may include:</p> <ul style="list-style-type: none"> <li>• rendering types and preferences</li> <li>• render lighting techniques</li> </ul>

	<ul style="list-style-type: none"> <li>views and scenes</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>leading hand</li> <li>foreman</li> <li>manager</li> <li>site engineer</li> <li>trainer</li> <li>mentor</li> <li>teacher</li> <li>team member</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>legislation</li> <li>personal protective equipment</li> <li>material safety management systems</li> <li>hazardous substances and dangerous goods code</li> <li>awards provisions</li> <li>safe work practices</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may refer to:</p> <ul style="list-style-type: none"> <li>liquid waste</li> <li>solid waste</li> <li>gas, fume, vapour, and smoke emissions, including fugitive emissions</li> <li>excessive energy and water use</li> <li>excessive noise</li> </ul>
<b>Resource requirements</b>	<p>Resource requirements may include:</p> <ul style="list-style-type: none"> <li>computer software</li> <li>stationary</li> <li>software reference documentation</li> <li>reference texts</li> <li>consumables</li> <li>computer</li> <li>printing equipment</li> </ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09211A Produce drawings or models for industrial piping**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce detailed, isometric and assembly drawings or models for the installation of industrial piping. Drawings/models are fully dimensioned and notated.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment. It includes the use of piping and instrumentation and process flow diagrams to inform work. Piping may be used in commercial or industrial contexts for materials, such as hot and cold water, air, gas, chemicals and oil.

Drawings/models will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B Interpret technical drawing

MEM09204A Produce basic engineering detail drawings

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                                  |     |   |
|---|----------------------------------|-----|---|
| 1 | Determine work requirements      | 1.1 | Check purpose, scope and information requirements for drawing/model   |
|   |                                  | 1.2 | Interpret available information relevant to project and work requirements, and identify and address further information needs |
|   |                                  | 1.3 | Identify and prepare equipment required to complete work  |
|   |                                  | 1.4 | Identify and apply relevant codes, standards and symbols used for pipe installation drawings/models                           |
|   |                                  | 1.5 | Identify and access organisational files, templates and symbols as required for work  |
|   |                                  | 1.6 | Identify environmental implications of inefficient systems and strategies for minimising impact                               |
|   |                                  |     |   |
| 2 | Analyse piping system components | 2.1 | Interpret piping and instrumentation diagrams and specifications  |
|   |                                  | 2.2 | Identify various pipe fittings and flanges and specify their application  |
|   |                                  | 2.3 | Describe the function and application of valves and auxiliary equipment   |
|   |                                  | 2.4 | Identify components used in piping project  |
|   |                                  | 2.5 | Identify occupational health and safety (OHS) factors applying to piping system   |

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|---|---|--|
| 3 | Produce drawings/models for installation of industrial piping systems | 3.1 Apply operating principles and specifications of piping systems and equipment to drawing/model   |
|   |   | 3.2 Detail pipes, valves and auxiliary equipment   |
|   |   | 3.3 Indicate vertical and horizontal offsets and hand wheel orientation  |
|   |   | 3.4 Apply OHS and environmental factors to drawing detail  |
|   |   | 3.5 Ensure drawing/model accurately reflects specifications, is presented according to organisational requirements and contains all relevant information |
|   |   | 3.6 Produce process flow, piping and instrumentation (P&ID) diagrams and isometric and spool drawings  |
|   |   | 3.7 Produce orthogonal single and double line arrangement drawings of pipe installation systems in accordance with engineer's sketches                   |
|   |   | 3.8 Prepare cutting lists from the arrangement and detail drawings   |
|   |   |  |
| 4 | Complete drawing/model task   | 4.1 Check and confirm drawing/model accuracy and compliance with industry standard   |
|   |   | 4.2 Ensure drawing/model is presented according to organisational requirements and contains all relevant information                                     |
|   |   | 4.3 File drawing according to workplace procedure  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment

- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- using and interpreting process flow and P&ID diagrams
- classifying valves in terms of the duties they perform (i.e. shutoff throttling and non-return)
- compiling cutting lists
- identifying pipe fittings and components
- identifying connections for valves (i.e. screwed, flanged or socket welded)
- applying symbols to identify pipe fittings
- correctly using line thickness material and construction to identify parts and pipe lines
- dimensioning the drawings

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- Australian standard specification of pipes, fittings and flanges
- standard valves and auxiliary equipment
- auxiliary equipment used in industrial piping
- principles of producing orthogonal and isometric piping drawings
- types of pipe fittings and components
- different types of industrial pipe systems
- terminology associated with industrial piping systems

### Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of installation drawings for industrial piping systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>unit</b>	<p>knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• produce fully notated and detailed drawings for commercial or industrial piping systems.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques</p>

	should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
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## Range Statement

<b>Available information</b>	Available information may include: <ul style="list-style-type: none"><li>• construction documents</li><li>• building and coordination information</li><li>• work specifications</li><li>• information for plant services equipment</li><li>• industry codes, standards and regulations</li><li>• design brief</li></ul>
<b>Piping systems</b>	Piping systems may include: <ul style="list-style-type: none"><li>• petro-chemical</li><li>• gas</li><li>• water</li><li>• wine and juice</li></ul>
<b>Piping system fittings and components</b>	Piping system fittings and components may include: <ul style="list-style-type: none"><li>• ball, stop, gate, angle and cocks</li><li>• flanges, t-pieces, elbows, plugs, caps, unions, connectors and reducers</li></ul>
<b>Piping drawings</b>	Piping drawings may include: <ul style="list-style-type: none"><li>• standard shop details for pipe spools and pipe supports</li><li>• standard shop drawings for layout and vendor equipment</li><li>• single line and double line orthogonal arrangement drawings</li><li>• transferring information from vendor equipment drawings to detail drawings</li><li>• compiling cutting lists from arrangement and detail drawings</li></ul>

## **Unit Sector(s)**

Drawing, drafting and design

## **Custom Content Section**

Not applicable.

# **MEM09212A Produce detailed drawings of steel to non-steel connections**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings for connections of non-steel to steel components. Drawings are completed to relevant Australian Standards (AS).

## **Application of the Unit**

This unit is suitable for those working within a drafting work environment. Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to AS 1100.101–1992 Technical drawing General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

This unit applies to detail drafting work for drawings where steel components are connected to non-steel components that may include items made from wood, concrete, glass, and so on.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Determine drawing requirements                  | 1.1 | Check purpose, scope and information requirements for drawing   |
|   |   | 1.2 | Interpret available information relevant to project and work requirements, and identify and address further information needs                     |
|   |   | 1.3 | Identify and prepare equipment required to complete work  |
|   |   | 1.4 | Identify and access organisational files, templates and symbols as required for work  |
| 2 | Identify features of components and connections | 2.1 | Identify type and features of components to be detailed and determine detailing requirements  |
|   |   | 2.2 | Identify impact of component material on detailing work and determine appropriate standards and drawing symbols                                   |
|   |   | 2.3 | Identify type and features of connections to be detailed from design information and determine detailing requirements                             |
|   |   | 2.4 | Identify any non-standard connections and determine detailing requirements  |
|   |   | 2.5 | Determine method of general dimensioning of the connection, including datum points and geometric shapes from engineer, sketches or specifications |
|   |   | 2.5 | Determine edge and other clearances for concrete and other non-steel members or components from designer  |
|   |   | 2.6 | Determine if surface finish or other information is required to be detailed   |



- |   |                                       |   |
|---|---------------------------------------|---|
|   | 2.7                                   | Identify materials to prevent electrolysis of dissimilar metals   |
| 3 | Detail steel to non-steel connections |   |
|   | 3.1                                   | Identify connection types from design information   |
|   | 3.2                                   | Identify reinforcement locations and avoid clashes with other connections   |
|   | 3.3                                   | Avoid interference with post-tensioning cables and holding down bolts for upper floor connections   |
|   | 3.5                                   | Detail steel to non-steel connections according to design information   |
|   | 3.6                                   | Identify and apply relevant codes, standards and symbols used for installation drawings   |
|   | 3.7                                   | Apply workplace occupational health and safety (OHS) and environmental procedures   |
|   | 3.8                                   | Provide measures to counter electrolytic action from dissimilar materials   |
| 4 | Complete drawing                      |   |
|   | 4.1                                   | Check final drawing to ensure all required specifications, symbols, dimensions, and components are included according to standards and the design specification |
|   | 4.2                                   | Present and store drawing according to organisational procedures  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- determining drawing implications of materials used and applying industry standard codes, symbols and notation

- using engineering and manufacturer catalogues, tables, standards and specifications
- applying surface texture symbols to comply to engineer's requirements
- applying toleranced dimensions to a detail drawing
- identifying material clashes
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with others, as required, to gain information required
- applying symbols, schedules and legends to the drawing using appropriate standards, codes and conventions
- applying surface texture symbols to comply with engineer's requirements
- applying dimension to a detail drawing using appropriate standards, codes and conventions
- arranging the views in a logical manner and in accordance with AS 1100.101–1992 Technical drawing – General principles
- correctly using line thickness and construction to identify parts

### Required knowledge

Required knowledge includes:

- effects of electrolytic action from dissimilar materials
- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- company standards for CAD
- order of drawing process
- features of components and connections
- geometric tolerances with regard to the roundness, straightness, flatness and concentricity of an engineering component
- company checking procedures for drawings
- layout and presentation of drawings
- the relevant statutory and authority requirements
- terminology associated with drawings
- the process of checking the completed drawing
- the process of storing paper drawings and electronic drawing files
- Australian standard bolting category identification system

### Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of drawings for installation of steel to non-steel components.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• produce detail drawings that meet industry standards and client requirements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and</p>

	reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

## Range Statement

<b>Available information</b>	Available information may include: <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
<b>Connection types</b>	Connection types may include: <ul style="list-style-type: none"> <li>• flexible connections: <ul style="list-style-type: none"> <li>• angle seats</li> <li>• bearing pads</li> <li>• flexible end plates</li> <li>• angle cleats</li> <li>• web side plates</li> </ul> </li> <li>• rigid connections: <ul style="list-style-type: none"> <li>• fully welded end plates</li> <li>• bolted moment end plates</li> <li>• stainless steel, aluminium, timber, glass and concrete connections</li> </ul> </li> </ul>
<b>Industry standards</b>	Industry standards may include, but are not limited to:

	<ul style="list-style-type: none"><li>• Building Codes of Australia (BSA)</li><li>• Australian Standards (AS)</li><li>• legislation requirements from Building Practitioner's Board (RBP)</li><li>• Australian Gas Codes (AGC)</li><li>• Sheet Metal and Air Conditioning Contractors National Association (SMACNA)</li><li>• third-party manufacturing and installation standards</li><li>• company standards</li><li>• guidelines</li><li>• general practices</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09213A Produce schematic drawings for hydraulic and pneumatic fluid power systems**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce detailed engineering drawings for hydraulic and pneumatic fluid power systems. The systems may be installed on individual stationary or mobile equipment or be part of a distributed system powered from a source separate from the equipment or machine where the hydraulic or pneumatic power is applied.

## **Application of the Unit**

This unit is suitable for individuals undertaking drafting in manufacturing and other industries that use fluid power equipment. The unit can apply to preparing drawings of whole or part of the fluid power system. Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Determine schematic drawing requirements | 1.1 Check purpose, scope and information requirements for drawing   |
|   |  | 1.2 Interpret available information relevant to project and work requirements, and identify and address further information needs |
|   |  | 1.3 Identify and prepare equipment required to complete work  |
|   |  | 1.4 Identify and apply relevant codes, standards and symbols used in the mechanical services industry for installation drawings   |
|   |  | 1.5 Identify and access organisational files, templates and symbols as required for work  |
|   |  | 1.6 Identify the features and operational function of basic pneumatic and hydraulic systems                                       |
| 2 | Identify system components               | 2.1 Identify gas or fluid used in the fluid power system  |
|   |  | 2.2 Identify typical hydraulic system components and their function   |
|   |  | 2.3 Identify typical pneumatic system components and their function   |
|   |  | 2.4 Identify environmental implications of inefficient fluid power systems and strategies for minimising impact                   |
|   |  | 2.5 Read and interpret the applicable sections of manufacturer's tables, charts, catalogues and specifications                    |

- |   |  |     |  |
|---|--|-----|--|
| 3 | Produce hydraulic system schematic drawing | 3.1 | Apply operating principles and specifications of hydraulic system and components to drawing work   |
|   |  | 3.2 | Complete schematic drawing according to industry standard for hydraulic fluid power systems, including use of accurate symbols and notations |
|   |  | 3.3 | Complete circuit diagram according to industry standard for hydraulic fluid power systems, including use of accurate symbols and notations   |
|   |  | 3.4 | Ensure schematic drawing is presented according to organisational requirements and contains all relevant information                         |
|   |  | 3.5 | Store schematic drawings according to organisational filing system   |
|   |  | 3.6 | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Produce pneumatic system schematic drawing | 4.1 | Apply operating principles and specifications of pneumatic system and components to drawing work   |
|   |  | 4.2 | Complete drawing according to industry standard for pneumatic fluid power systems, including use of accurate symbols and notations           |
|   |  | 4.3 | Complete circuit diagram according to industry standard for pneumatic fluid power systems, including use of accurate symbols and notations   |
|   |  | 4.4 | Ensure drawing is presented according to organisational requirements and contains all relevant information                                   |
|   |  | 4.5 | Store schematic drawings according to organisational filing system   |
|   |  | 4.6 | Apply workplace OHS and environmental procedures   |
| 5 | Consult appropriately with other           | 5.1 | Verify the parameters of the brief and clarify specifications with appropriate personnel   |
|   |  | 5.2 | Identify and consult with support services, as required  |



disciplines

5.3 Present and explain drawings and diagrams at appropriate stages of the project

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- numeracy skills, including four basic functions, fractions, and simple algebra and formulae sufficient to calculate flow, volume, area, pressure and other necessary parameters relevant to a fluid power system
- using and maintaining drawing equipment
- applying relevant codes, standards and symbols used for hydraulic and pneumatic systems
- drafting skills, including:
  - applying spatial principles to achieve scale and proportion
  - using appropriate lines and symbols
  - dimensioning and tolerancing
  - production of title block, material lists and other appropriate symbols

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing schematics
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with the tools and materials used for drawing
- quality assurance procedures
- order of drawing process
- company checking procedures for drawings
- operating principles of pneumatic systems and components
- operating principles of hydraulic systems and components

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of drawings and schematics for the pneumatic and hydraulic fluid power systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"><li>• work within typical site/teamwork structures and methods</li><li>• apply worksite communication procedures</li><li>• comply with organisational policies and procedures, including quality requirements</li><li>• participate in work meetings</li><li>• comply with quality requirements</li><li>• use industry terminology</li><li>• apply appropriate safety procedures</li><li>• produce schematic drawings of hydraulic and pneumatic power systems according to industry standard and client requirements.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning</p>

	<p>and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
<b>Typical hydraulic components</b>	<p>Typical hydraulic components include:</p> <ul style="list-style-type: none"> <li>• basic drive circuits</li> <li>• basic safety/relief circuits</li> <li>• control components, including: <ul style="list-style-type: none"> <li>• programmable logic controllers (PLCs)</li> <li>• other input/output circuitry</li> <li>• sensors</li> <li>• limit switches and stops</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• mnemonic coding and associated equipment</li> <li>• human interface equipment (e.g. terminals, key pads, levers, switches and buttons)</li> <li>• fluid reservoirs</li> <li>• piping and hoses and associated fittings</li> <li>• pumps</li> <li>• filters</li> <li>• valves</li> <li>• control gear</li> <li>• drive/displacement units</li> <li>• filters and strainers</li> <li>• gauges and instruments, including: <ul style="list-style-type: none"> <li>• pressure and temperature gauges</li> <li>• liquid level gauges</li> <li>• thermometers</li> <li>• thermocouples</li> <li>• manometers</li> <li>• piezometers</li> <li>• pumps, motors/turbines</li> <li>• linear actuators</li> </ul> </li> </ul>
<b>Typical pneumatic components</b>	<p>Typical pneumatic components include:</p> <ul style="list-style-type: none"> <li>• control system, including: <ul style="list-style-type: none"> <li>• PLCs</li> <li>• other input/output circuitry</li> <li>• sensors</li> <li>• limit switches and stops</li> <li>• mnemonic coding and associated equipment</li> <li>• human interface equipment (e.g. terminals, key pads, levers, switches and buttons)</li> </ul> </li> <li>• receivers and other reservoirs</li> <li>• interlocks</li> <li>• piping and tubing</li> <li>• pumps</li> <li>• compressors</li> <li>• strainers and filters</li> <li>• valves</li> <li>• drive/displacement units</li> <li>• pipes (rigid and flexible)</li> <li>• valves (types and functions)</li> <li>• filters (types and functions)</li> </ul>

	<ul style="list-style-type: none"><li>• gauges and instruments:<ul style="list-style-type: none"><li>• pressure and temperature gauges</li><li>• liquid level gauges</li><li>• thermometers</li><li>• thermocouples</li><li>• manometers</li><li>• piezometers</li></ul></li><li>• pipe fittings (elbows/bends)</li><li>• air motors</li><li>• linear actuators</li></ul>
<b>Pneumatic system diagrams</b>	Pneumatic system diagrams may include: <ul style="list-style-type: none"><li>• basic drive circuits</li><li>• basic safety/relief circuits</li><li>• control circuits</li><li>• pressure reducing volume/flow control</li><li>• sensing circuits</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• designer</li><li>• engineer</li><li>• supervisor</li></ul>
<b>Support services</b>	Support services may include: <ul style="list-style-type: none"><li>• estimating department and personnel</li><li>• engineering department and personnel</li><li>• drafting department and personnel</li><li>• project manager</li><li>• factory manager or staff</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# MEM09214A Perform advanced engineering detail drafting

## Modification History

Release 1 - New unit of competency

## Unit Descriptor

This unit of competency covers producing assembly, sectioned drawings and specialised dimensioning and auxiliary views to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, or equivalent. It includes determining and applying tolerances and dimensions, as required, to complete engineering detail drawing.

## Application of the Unit

Skills covered by this unit are applied individually or in a team environment where comprehensive responsibility for the production of the drawing is exercised, and critical dimensions and associated tolerances are determined, where required.

This may include tolerancing and dimensioning for location, form, orientation, profile and runout and includes geometric tolerancing and use of modifiers. Drawings and all tolerances and dimensions are to AS 1100.101–1992 Technical drawing – General principles.

Drawings will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM09002B Interpret technical drawing

MEM09204A Prepare basic engineering detail drawings

MEM30012A Apply mathematical techniques in a manufacturing, engineering or related environment

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Prepare for drawing work	1.1	Check purpose, scope and presentation requirements for drawing task
		1.2	Determine the information requirements for the finished part or item and its interaction with the next level of assembly or process
		1.3	Undertake requests for further information (RFI) to designer where information cannot be obtained or calculated
		1.4	Identify relevant standards and terminology, symbols and notation required to comply with standard and design
		1.5	Prepare equipment and set up software for drawing work
2	Identify and apply dimensions and tolerances for drawing	2.1	Determine methods of general dimensioning and tolerancing, classes of fit and forms of geometric shapes from engineer, sketches or specifications
		2.2	Select dimensioning and tolerancing scheme and symbols consistent with standards and design requirements
		2.3	Identify and confirm datum points
		2.4	Apply the principles of general dimensioning to engineering drawing

- |   |   |     |  |
|---|---|-----|--|
|   |   | 2.5 | Apply the principles of general tolerancing engineering drawing  |
|   |   | 2.6 | Check that each dimension and tolerance symbol can be clearly interpreted for application  |
|   |   | 2.7 | If required, re-dimension toleranced drawing with new datum positions  |
|   |   | 2.8 | Extract information from dimensioned drawing   |
| 3 | Prepare assembly, layout and detail drawings  | 3.1 | Produce sectioned third angle orthogonal assembly drawings   |
|   |   | 3.2 | Project a primary auxiliary view   |
|   |   | 3.3 | Produce finished assembly drawings complete with material/part/cutting lists, cross-referencing and any required dimensions (overall and centre-to-centre) |
|   |   | 3.4 | Produce all drawings to AS 1100.101–1992 Technical drawing – General principles, or equivalent and enterprise presentation standards                       |
|   |   | 3.5 | Check that all required tolerances and dimensions are on the drawing   |
|   |   | 3.6 | Apply workplace occupational health and safety (OHS) and environmental procedures  |
| 4 | Select material, components and/or assemblies | 4.1 | Interpret specifications to determine material requirements  |
|   |   | 4.2 | Select components, material and/or assemblies from data sheets or manufacturer catalogues to meet specifications   |
|   |   | 4.3 | Produce bill of materials  |
| 5 | Complete drawing work                         | 5.1 | Verify drawing compliance with specifications  |
|   |   | 5.2 | Check drawings to ensure that assembly/fabrication is possible   |
|   |   | 5.3 | Document and save drawings according to enterprise   |



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## Required Skills and Knowledge

### Required skills

Required skills include:

- obtaining all relevant work instructions and requirements
- producing all drawings in accordance with AS 1100.101–1992 Technical drawing – General principles, or equivalent
- obtaining all relevant data sheets and catalogues
- calculating required limits, fits, datum references and geometric tolerances where they are not supplied from designer or reference material
- checking drawings for conformance to specification
- checking drawings to ensure that assembly/fabrication is possible
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- reading and selecting correct toleranced dimensions to meet the required class of limit or fit as selected by the engineer or other designer from the specifications
- applying symbols for:
  - dimensions
  - dimension origin
  - reference values
- applying tolerance symbols for:
  - datum identification
  - form
  - location
  - profile
  - runout
  - modifiers
- inserting or calculating geometric tolerances with regard to the roundness, straightness, flatness, concentricity, and so on, of an engineering component
- applying schedules and legends to the drawing
- converting between unilateral, bilateral and limit of size or direct tolerances
- applying tolerances to meet the individual fit classifications between a shaft and hole (clearance, interference and transition)

- determining part quantities and material lengths for inclusion in the parts/material/cutting list

## Required knowledge

Required knowledge includes:

- specifications and/or requirements of the component, assembly or layout to be drawn
- functional operation of the component/assembly to be drawn
- surfaces which are to be in contact or separated
- appropriate type of fit for contacting surfaces
- reasons for selecting the chosen type of fit
- calculation methods for determining limits, fits, datum references and geometric tolerances
- effect of surface finish on the performance/operation of surfaces
- all appropriate lineal, diametric and geometric tolerances
- procedures for determining tolerances
- requirements of AS 1100.101–1992 Technical drawing – General principles, or equivalent for drawings to be produced
- specifications of the components, materials and/or assemblies
- appropriate components and materials from supplier/manufacture catalogues
- reasons for selecting the chosen components and/or materials
- procedures for checking and approving drawings
- reasons for checking the drawings to ensure that manufacturing/assembly is possible, efficient and cost-effective
- drawing specifications
- methods of manufacture/assembly/fabrication from drawings
- unnecessary or inappropriate tolerances
- hazards and control measures associated with performing advanced engineering detail drafting, including housekeeping
- safe work practices and procedures
- engineering features, terminology and abbreviations
- hatching techniques such as large sections, small sections, thin sections and designation of materials
- sectioning systems, such as revolved section, removed section, local or part section, offset section, aligned section and interposed section
- types of bearings
- sectioning conventions, such as screw threads, shafts and rods, webs and thin sections
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- role of datum points in dimensioning and tolerancing a detail engineering drawing
- RFI process for project or enterprise
- symbols used for dimensioning
- symbols used for tolerancing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform advanced engineering detail drafting techniques to produce assembly, sectioned drawings and specialised dimensioning and auxiliary views to AS 1100.101–1992 Technical drawing – General principles, or equivalent.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• perform required calculations to determine tolerances and fits required to meet design requirements</li> <li>• produce drawings to AS 1100.101–1992 Technical drawing – General principles, with all components identified.</li> </ul>
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should

	<p>not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing advanced engineering detail drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Equivalent standard</b>	<p>Equivalent standard may include:</p> <ul style="list-style-type: none"> <li>AS 1654.1–1995 ISO system of limits and fits – Bases of tolerances, deviations and fits</li> </ul>
<b>Dimensioning</b>	<p>Dimensioning may include:</p> <ul style="list-style-type: none"> <li>symbols</li> <li>lines</li> <li>numerical value</li> <li>linear</li> <li>angular</li> <li>diameter</li> <li>radius</li> <li>not to scale (NTS)</li> <li>auxiliary</li> <li>reference</li> <li>common feature</li> <li>tabular presentation</li> <li>squares</li> </ul>

	<ul style="list-style-type: none"> <li>• holes</li> <li>• screw heads</li> <li>• tapers/slope</li> <li>• profiles</li> <li>• notes</li> </ul>
<b>Tolerancing</b>	<p>Tolerancing may include:</p> <ul style="list-style-type: none"> <li>• basic dimension</li> <li>• bilateral</li> <li>• unilateral</li> <li>• zone</li> <li>• datum</li> <li>• tolerance grade</li> <li>• datum feature</li> </ul>
<b>Symbols used for tolerancing</b>	<p>Symbols used for tolerancing may include, but are limited to:</p> <ul style="list-style-type: none"> <li>• datum identification</li> <li>• form</li> <li>• location</li> <li>• profile</li> <li>• runout</li> <li>• modifiers</li> </ul>
<b>Symbols used for dimensioning</b>	<p>Symbols used for dimensioning may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• diameter</li> <li>• square</li> <li>• counterbore</li> <li>• countersink</li> <li>• depth</li> <li>• dimension origin</li> <li>• reference value</li> <li>• slope</li> <li>• taper</li> <li>• radius</li> <li>• spherical radius</li> </ul>
<b>Condition</b>	<p>Condition may include:</p> <ul style="list-style-type: none"> <li>• fit</li> <li>• limits of size</li> <li>• fundamental deviation</li> <li>• allowance</li> <li>• maximum material condition</li> </ul>

	<ul style="list-style-type: none"> <li>• least material condition</li> </ul>
<b>Geometry tolerancing</b>	<p>Geometry tolerancing may include:</p> <ul style="list-style-type: none"> <li>• virtual condition and size</li> <li>• geometric reference frame</li> <li>• principle of independency</li> <li>• tolerance (form, profile, orientation and position)</li> <li>• characteristics, including:             <ul style="list-style-type: none"> <li>• straightness</li> <li>• flatness</li> <li>• circularity</li> <li>• cylindricity</li> <li>• profile</li> <li>• squareness</li> <li>• parallelism</li> <li>• angularity</li> <li>• runout</li> </ul> </li> <li>• tolerance indication method</li> <li>• projected tolerances</li> <li>• statistical value tolerances</li> </ul>
<b>Assembly drawing types</b>	<p>Assembly drawing types may include:</p> <ul style="list-style-type: none"> <li>• general assembly</li> <li>• detailed assembly</li> <li>• layout drawings</li> <li>• installation drawings</li> <li>• erection diagrams</li> <li>• shop and field assemblies</li> <li>• pictorial exploded drawings</li> </ul>
<b>Information from dimensioned drawing</b>	<p>Information from dimensioned drawing may include:</p> <ul style="list-style-type: none"> <li>• limits of size</li> <li>• fundamental deviation</li> <li>• allowance</li> <li>• tolerance, including:             <ul style="list-style-type: none"> <li>• maximum material condition</li> <li>• least material condition</li> <li>• fit</li> </ul> </li> </ul>
<b>Drawings</b>	<p>Drawings must include:</p> <ul style="list-style-type: none"> <li>• accurate representation, including any necessary hidden detail of the specific assembly</li> <li>• border, title block and projection symbols</li> </ul>

	<ul style="list-style-type: none"><li>• accurate line work</li><li>• appropriately positioned views</li><li>• hatching to AS 1100.101–1992 Technical drawing – General principles specifications (sectioned third angle orthogonal assembly drawings)</li><li>• correct use of terminology and abbreviations</li></ul>
<b>Auxiliary projection</b>	<p>Auxiliary projection (primary views only) may include:</p> <ul style="list-style-type: none"><li>• purpose for auxiliary projection</li><li>• planes of projection</li><li>• projection involving circular components</li><li>• border, title block and projection symbols</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM09215A Supervise detail drafting projects

### Modification History

Release 1 - New unit of competency

### Unit Descriptor

This unit of competency covers the skills and knowledge required to supervise work of other detail draftspersons to confirm drafting projects are accurate and comply with Australian Standards and project briefs from clients and designers.

### Application of the Unit

This unit is suitable for those working within a drafting work environment and can be applied across all areas of drafting. It covers skills required by those responsible for confirming that detail drafting project outcomes are achieved. This can include identifying the computer-aided design (CAD) platform for a project from available options if this is not specified in the brief, and assisting with aspects of other draftspersons' work, including those related to complying with the detail drafting brief in relation to budget, timeline and quality.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### Pre-Requisites

MEM09002B	Interpret technical drawing
MEM09204A	Produce basic engineering detail drawings
MEM09214A	Perform advanced engineering detail drafting
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Confirm client or designer detail drafting briefs | 1.1 | Interpret and verify objectives, scope, parameters and drawing requirements   |
|   |   | 1.2 | Identify and address further information needs  |
|   |   | 1.3 | Identify any regulatory and commercial requirements   |
|   |   | 1.4 | Identify whether project brief requires additional expertise, or resource requirements  |
|   |   | 1.5 | Identify any additional skill or training needs to deliver detail drafting outcomes   |
|   |   | 1.6 | Identify file and software requirements, including requirements to transfer to other file formats, and any required customisation |
| 2 | Lead detail drafting project                      | 2.1 | Confirm work plan, including timelines, roles and responsibilities  |
|   |   | 2.2 | Identify CAD software platform to be used and conduct customisation, as required  |
|   |   | 2.3 | Select organisational files, library, templates and symbols as required for work  |
|   |   | 2.4 | Check information accuracy and generate requests for further information (RFIs), as required                                      |
|   |   | 2.5 | Confirm other detail draft persons understand work  |

- requirements clearly
- 2.6 Clarify that documentation requirements for detail drafting work are understood by detail draftspersons
  - 2.7 Liaise with engineers, design draftspersons and/or clients, as required, to provide progress updates, confirm detail design requirements and other details
- 3 Monitor detail drafting outcomes
    - 3.1 Monitor progress of drafting work against timelines and brief
    - 3.2 Provide support to detail drafting personnel, as required
    - 3.3 Check that design variations are documented
    - 3.4 Review consistency of 3-D models and detail drawings where multiple models or drawings are required
    - 3.5 Check final models and drawings against Australian Standards and specifications
    - 3.6 Monitor compliance with workplace occupational health and safety (OHS) and environmental procedures
    - 3.7 Check that required sign-off for drawings is obtained
    - 3.8 Check that project documents are stored and filed according to organisational procedures
    - 3.9 Provide detail draftspersons with feedback on project outcomes
  - 4 Monitor presentation of drawings
    - 4.1 Check that drawings are presented according to industry standard and that outcomes comply with the project brief
    - 4.2 Check that all required documentation is completed and presented to engineers, designers and/or clients as required

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work and to compile project plans and documentation
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- interpersonal skills necessary to carry out face-to-face and telephone discussions
- using and maintaining drawing equipment and software programs
- teamwork and communication skills
- interpreting and applying AS 1100.101–1992 Technical drawing – General principles, and other relevant standards
- applying RFI procedures
- customising the relevant CAD program variables to suit the applicable drafting standards/procedures
- customising menus to suit the applicable drafting standards/procedures
- customising the system defaults to suit the applicable drafting standards/procedures
- developing macros
- storing drawing files according to workplace procedures
- evaluating detail drafting work progress and quality and identifying areas for improvement

### **Required knowledge**

Required knowledge includes:

- general knowledge of different approaches to detail drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and OHS issues associated with detail drawings
- quality assurance procedures
- company standards and procedures for CAD and detail drafting work
- information needs associated with engineering detail drawings
- OHS and environmental standards and procedures
- sources and range of reference material
- requirements of AS 1100.101–1992 Technical drawing – General principles, or equivalent for drawings to be produced
- specifications of the components, materials and/or assemblies
- procedures for checking and approving detail drawings
- procedures for customising identified system variables
- reasons for customising the system variables
- range of file types and their features and uses
- CAD file types, their uses and transfer requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to lead detail draftspersons and confirm project outcomes are compliant with project brief and Australian Standards.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in and lead work meetings</li> <li>• monitor and lead progress of detail drafting work and provide support to team members as required</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• monitor detail drafting projects and supervise detail draftsperson to confirm drafting work meets industry and client requirements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>

	<p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• design brief</li> </ul>
<b>Project parameters</b>	<p>Project parameters may include:</p> <ul style="list-style-type: none"> <li>• budget</li> <li>• timelines</li> <li>• content</li> <li>• relationship with other project elements</li> <li>• engineering specifications</li> <li>• drawing requirements</li> <li>• regulatory and quality standards</li> <li>• reporting requirements</li> </ul>

<b>File types</b>	<p>File types may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• Hewlett-Packard Graphics Language (HPGL) formatted circuit board, computer-aided manufacturing (CAM) files into Drawing Exchange Format (DXF) files</li><li>• Initial Graphics Exchange Specification (IGES)</li><li>• AutoCAD Drawing Interchange Format or DXF</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09216A Interpret and produce curved 3-D shapes and patterns**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers producing and interpreting lines and plan drawings using manual or computer-aided design (CAD) or drafting techniques.

## **Application of the Unit**

This unit applies to drawing and lofting principles relevant to procedures used to produce lines, plan drawings and loftings. Common applications of this unit are in marine vessel construction.

In a marine setting, tasks may be related to a variety of hull designs; section development, such as curved and raking transom; conical development and camber development methods. General arrangement plans may also be addressed to provide a greater drawing diversity.

All drawings/data should comply with industry requirements.

Straightforward take-offs from lofted drawings is covered by MEM12007D Mark off/out structural fabrications and shapes. Also, where transfer of lines to lofting floor or other surface is carried out, MEM12007D Mark off/out structural fabrications and shapes, should be selected in addition to this unit.

If a CAD system is used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine drawing/lofting requirements	1.1	Check purpose, scope and information requirements for task
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and apply relevant codes, standards and symbols relevant to work
		1.5	Consult appropriate personnel to ensure the work is coordinated effectively with others involved in the project
		1.6	Obtain and apply workplace occupational health and safety (OHS) and environmental procedures for work
2	Apply drawing/lofting procedures	2.1	Apply workplace procedures to retrieve and apply required information
		2.2	Set up drawing equipment and accessories to suit job requirements
		2.3	Identify and apply drafting/lofting procedures to suit specified drawing requirements
		2.4	Record alterations required to offset measurements, as applicable
		2.5	Produce drawings/loftings that are consistent with work and industry requirements



- |   |                                |     |  |
|---|--------------------------------|-----|--|
| 3 | Submit lines and plan drawings | 3.1 | Ensure work meets specifications and submit drawings according to workplace procedures           |
|   |                                | 3.2 | Where applicable, supply altered offset measurements and relevant information related to drawing |

## Required Skills and Knowledge

### Required skills

Required skills include:

- reading, interpreting and following information on written job instructions, specifications, client briefings, standard operating procedures, charts, lists, drawings and other applicable reference documents
- analysing and organising information, and planning and sequencing operations
- checking and clarifying task-related information
- checking for conformance to specifications
- measuring and performing computations, including geometric and numerical calculations/formulae within the scope of this unit
- drawing and sketching skills to create 3-D drawings
- applying spatial principles to achieve scale and proportion
- using and maintaining drawing equipment
- applying symbols, schedules and legends to the drawing
- presenting drawing according to industry standard, complete with all required information
- handling and storing drawings according to workplace practice

### Required knowledge

Required knowledge includes:

- hazards and control measures associated with interpreting and producing curved 3-D shapes, including housekeeping
- safe work practices and procedures
- vessel design characteristics, including performance, stability and construction methods
- spatial concepts
- procedures used to produce lines, plan drawings and loftings
- drawing principles and conventions
- section development, such as curved and raking transom, conical development and camber development methods
- presentation requirements for completed work

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to interpret and produce curved 3-D shapes.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

Specifically the candidate must be able to:

- work within typical site/teamwork structures and methods
- apply worksite communication procedures
- comply with organisational policies and procedures, including quality requirements
- participate in and supervise work meetings
- monitor and supervise progress of detail drafting work and provide support to team members as required
- comply with quality requirements
- use industry terminology
- apply appropriate safety procedures
- interpret and produce curved 3-D shapes and patterns.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and

reporting associated with interpreting and producing curved 3-D shapes or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Range Statement**

Not applicable.

**Unit Sector(s)**

Drawing, drafting and design

**Custom Content Section**

Not applicable.

# **MEM09217A Prepare plans for pipe and duct fabrication**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to prepare installation plans and drawings for pipe and duct fabrication. It entails identifying and documenting methods most suitable for joining, cutting and supporting pipe and duct used in air conditioning systems.

## **Application of the Unit**

This unit would be applied by draftspersons operating within the air conditioning industry. Application of this unit includes identifying suitable methods of joining and supporting duct and pipes for copper, mild steel, stainless steel and plastic; identifying the correct methods for joining and cutting in plans; and correctly aligning the methods with material types.

Work is conducted to meet predetermined project specifications and requires access to and interpretation of organisational and industry catalogues and product specifications.

Drawings/models will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM09002B Interpret technical drawing

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Access and interpret specifications	1.1	Interpret project specifications and requirements for pipework, including layout, sizing and type of pipe and duct required
		1.2	Determine implications and requirements for pipe fabrication and support
		1.3	Access and interpret organisational and industry standards, information and catalogues to obtain required product specifications
2	Document pipe fabrication	2.1	Select methods of joining and cutting pipe that are appropriate for the materials being used
		2.2	Document pipe fabrication requirements on plans
		2.3	Include instructions for electrolysis of dissimilar materials on plans where required
3	Document support for pipework	3.1	Select methods for supporting pipework that are appropriate for the materials being used
		3.2	Document pipe support requirements on plans
		3.3	Include instructions for electrolysis of dissimilar materials on plans where required
4	Document duct fabrication	4.1	Select methods of joining and cutting duct that are appropriate for the materials being used
		4.2	Document duct fabrication requirements on plans

		4.3	Include instructions for electrolysis of dissimilar materials on plans where required
5	Document duct support	5.1	Select methods for supporting duct work that are appropriate to the materials being used
		5.2	Document duct support requirements on plans
		5.3	Include instructions for electrolysis of dissimilar materials on plans where required
6	Complete and store drawings	6.1	Complete drawings and associated technical information in accordance with project requirements and company procedures
		6.2	Process drawings and associated documentation for approval in accordance with organisational requirements
		6.3	Store drawings and associated documentation in accordance with organisational procedures

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- selecting methods of joining, cutting and supporting pipe appropriate to work requirements
- selecting methods of joining, cutting and supporting duct appropriate to work requirements
- completing sketches and drawings with required information for fabrication
- presenting drawings and documentation according to industry standard

## Required knowledge

Required knowledge includes:

- relevant codes of practice
- industry standards
- occupational health and safety (OHS) requirements
- duct construction
- types of duct:
  - supply air (S/A)
  - return air (R/A)
  - toilet exhaust
  - kitchen exhaust
  - smoke spill
  - fire rated
  - textile duct
  - sub-ducts
  - filter plenums
- types of duct insulation (materials and facings):
  - foil face
  - perf face
  - black matt
  - melinex lining
  - galvabond
  - polyester
  - fibreglass
  - jointing
  - flanges
  - seams
- pipe construction:
  - materials
  - copper
  - steel
  - Acrylonitrile – Butadiene – Styrene (ABS)
  - polyvinyl chloride (PVC)
  - stainless steel
- pipework insulation:
  - fibreglass
  - polystyrene
  - facings
  - nitrile rubber

- methods for supporting:
  - clamping
  - hanging
  - fixings
- sketching pipe and duct fabrication joining methods for pipe and duct work (steel, copper, stainless steel, aluminium and plastic)
- brackets and supports

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret specifications to select appropriate methods of pipe and duct fabrication for a range of materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• determine and document appropriate pipe and duct work fabrication and support requirements to meet project specifications and industry standards.</li> </ul>
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate



	<p>simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Methods of joining</b>	<p>Methods of joining may include:</p> <ul style="list-style-type: none"> <li>• spigots</li> <li>• flanges</li> <li>• mild steel angles</li> <li>• weld</li> <li>• braze</li> <li>• solder</li> </ul>
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	<ul style="list-style-type: none"><li>• seal</li><li>• bolt</li></ul>
<b>Materials</b>	Materials must include: <ul style="list-style-type: none"><li>• copper</li><li>• mild steel</li><li>• stainless steel</li><li>• plastic</li></ul>
<b>Methods for supporting</b>	Methods for supporting may include: <ul style="list-style-type: none"><li>• clamping</li><li>• hanging</li><li>• steel profile types</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09218A Participate in drafting projects for building services**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to participate in the coordination of services within buildings sites. This entails interpreting plans and specifications of other services, negotiating with other services and participating in project meetings. It also necessitates the sequencing of plans to meet the requirements of other services in a multi-service site.

### **Application of the Unit**

This unit would be applied by draftspersons providing detailed engineering drawings that must be integrated with other building services. It requires interpretation of drawings and specifications from a variety of services and application of knowledge of building construction components and types to drawings development.

If work requires entering construction worksite, then the unit CPCCOHS1001A Work safely in the construction industry, should also be selected.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B Interpret technical drawing

MEM09204A Produce basic engineering detail drawings

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Examine site information	1.1	Identify building features and types of building services from drawings and project information
		1.2	Identify functions of building services, requirements for installation of components and implications for drawing work
		1.3	Extract all required information from services and project documentation
2	Integrate information from other services	2.1	Prepare drawings that incorporate protocols for a multi-service site
		2.2	Facilitate sequencing and coordination with other services
		2.3	Integrate the functions of other building services into drafting work practices
		2.4	Ensure installation plans are appropriate for building types and components
3	Participate in site and coordination meetings	3.1	Identify and apply meeting procedures and objectives
		3.2	Present points of view and comments, including agreement and dissent, in a logical, persuasive and orderly manner
		3.3	Obtain and consider points of view of other members
		3.4	Submit drawings to project supervisor
		3.5	Integrate feedback into drawings and prepare final draft

- |   |                  |     |  |
|---|------------------|-----|--|
| 4 | Complete drawing | 4.1 | Check final drawing and documentation to ensure all required specifications, symbols, dimensions and components are included according to standards and the design specification |
|   |                  | 4.2 | Present and store drawing and documentation according to organisational procedures   |

## Required Skills and Knowledge

### Required skills

Required skills include:

- drafting skills and interpreting drawings from full range of building services
- interpersonal skills to work with others and negotiate final plans
- applying various codes of practice, specifications and standards
- producing plans according to industry standard
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- applying knowledge of building construction components and types to drawings

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- types and functions of building services and building construction components and requirements for installation
- location of building services on drawings
- protocols for coordination of building services
- strategies for cooperative practices
- a range of building types (concrete, timber, block work, steel-framed, and so on)
- a range of construction types (slabs, walls, ceilings and roofs)
- a range of architectural/structural features

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with

the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply drawing specifications and industry standards in the production of drawings that integrate with other building services.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• consult with other services in a multi-service worksite to interpret functions, protocols and negotiate processes and timelines</li> <li>• modify drafting plans and sequences to integrate information from other services</li> <li>• modify plans and sequences in response to delays</li> <li>• participate in site and coordination meetings</li> <li>• correlate processes, timelines with drawings and specifications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to</p>

	<p>accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Types of services in a building</b>	<p>Types of services in a building include:</p> <ul style="list-style-type: none"> <li>• architectural</li> <li>• structural</li> <li>• electrical</li> <li>• power</li> <li>• lighting</li> <li>• fire</li> <li>• hydraulic</li> <li>• mechanical</li> <li>• communications</li> <li>• lift</li> <li>• syphonic drawings</li> </ul>
<b>Building types</b>	<p>Building types include:</p>

	<ul style="list-style-type: none"> <li>• concrete</li> <li>• block</li> <li>• tilt panel</li> <li>• in-situ</li> <li>• pre-cast</li> <li>• formed</li> <li>• bondeck</li> <li>• hollow core</li> </ul>
<b>Available information</b>	<p>Available information may include:</p> <ul style="list-style-type: none"> <li>• floor plans, elevations, sections and site layout drawings</li> <li>• construction documents</li> <li>• building and coordination information</li> <li>• work specifications</li> <li>• information for plant services equipment</li> <li>• industry codes, standards and regulations</li> <li>• project brief</li> </ul>
<b>Protocols for a multi-service site</b>	<p>Protocols for a multi-service site include:</p> <ul style="list-style-type: none"> <li>• sequencing of installation</li> <li>• consultations</li> <li>• meetings</li> </ul>
<b>Codes, standards and industry regulations</b>	<p>Codes, standards and industry regulations may include:</p> <ul style="list-style-type: none"> <li>• Australian Standards (AS):             <ul style="list-style-type: none"> <li>• AS/NZS 1668 Set:2005 The use of ventilation and air conditioning in building Set</li> <li>• AS 1682.1–1990 Fire dampers – Specification</li> <li>• AS 4254–2002 Ductwork for air-handling systems in buildings</li> </ul> </li> <li>• building codes</li> <li>• gas, water and electricity regulations</li> <li>• standards for smoke alarms</li> <li>• occupational health and safety (OHS) codes of practice</li> </ul>

## Unit Sector(s)

Drawing, drafting and design



## Custom Content Section

Not applicable.

# **MEM09219A Prepare drawings for fabricated sheet metal products**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to prepare detail drawings for fabrication of sheet metal products.

## **Application of the Unit**

This unit would be applied by draftspersons operating within the manufacturing and engineering industry. Application of this unit includes documenting product features and fabrication methods. Output may be required in 2-D or 3-D models.

Work is conducted to meet predetermined project specifications and requires access to and interpretation of organisational and industry catalogues and product specifications.

Drawings/models will usually be carried out with the use of computer-aided design (CAD) systems but may also be done manually. Drawings are produced to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, from predetermined critical dimensions and specifications. If CAD systems are to be used, the unit MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should also be selected.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM09002B Interpret technical drawing

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Access and interpret specifications	1.1	Identify design process for fabricated sheet metal products
		1.2	Interpret specifications and requirements for product and determine implications and requirements for fabrication
		1.3	Access and interpret organisational and industry standards, information and catalogues to obtain required product specifications
2	Identify fabrication techniques	2.1	Identify features of sheet metal products and techniques used in fabrication
		2.2	Identify characteristics of metal materials used in fabricated products and implications for fabrication techniques
		2.3	Identify terminology, symbols and standards used in drawings for fabricated products and required inclusions for fabrication drawings
3	Prepare detail drawing	3.1	Perform calculations required to complete drawings to specifications
		3.2	Lay out the drawing in accordance with specifications and industry conventions
		3.3	Ensure drawing accurately reflects specifications, is presented according to organisational requirements and contains all relevant information, including full notation and dimensioning
		3.4	Apply workplace occupational health and safety (OHS)

and environmental procedures

- |   |                             |     |  |
|---|-----------------------------|-----|--|
| 4 | Document and store drawings | 4.1 | Document drawings and associated technical information in accordance with project requirements and organisational procedures |
|   |                             | 4.2 | Store drawings according to organisational procedures  |

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions, relevant codes of practice and specifications for drawing work
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- using and maintaining drawing equipment
- applying spatial principles to achieve scale and proportion
- interpersonal skills to consult with other disciplines
- applying drawing techniques and conventions to inform fabrication
- applying symbols, schedules and legends to the drawing
- arranging the views in a logical manner and in accordance with AS 1100.101–1992 Technical drawing – General principles
- correctly using line thickness and construction to identify parts
- using engineering and manufacturer catalogues, tables, standards and specifications
- applying surface texture symbols to comply to engineer's requirements

### Required knowledge

Required knowledge includes:

- relevant codes of practice
- industry standards, drawing symbols and conventions
- OHS requirements
- general knowledge of different approaches to drawing
- features and uses of materials and components used in sheet metal fabricated products
- characteristics of sheet metal and implications for drawing
- techniques used to fabricate sheet metal products

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret specifications and apply in detail drawings for fabricated sheet metal products.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• interpret and apply specifications for fabricated products, and produce detail drawings according to industry standards and conventions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include</p>

	<p>equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Fabrication techniques</b>	<p>Fabrication techniques include:</p> <ul style="list-style-type: none"> <li>• joining techniques: <ul style="list-style-type: none"> <li>• spigots</li> <li>• flanges</li> <li>• mild steel angles</li> <li>• weld</li> <li>• braze</li> <li>• solder</li> <li>• seal</li> <li>• bolt</li> </ul> </li> <li>• cutting methods: <ul style="list-style-type: none"> <li>• thermal and mechanical cutting</li> </ul> </li> <li>• forming and shaping of plate, sheet and tubular ferrous and non-ferrous metal</li> <li>• folding and unfolding</li> </ul>
<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>• mild steel</li> </ul>

	<ul style="list-style-type: none"><li>• stainless steel</li></ul>
<b>Drawing details</b>	<p>Drawing details may include:</p> <ul style="list-style-type: none"><li>• base faces, contour flanges and contour rolls</li><li>• secondary faces, contour flanges and contour rolls</li><li>• sheet metal parameters</li><li>• flanges</li><li>• hems, folds and bends</li><li>• corner rounds and chamfers</li><li>• sheet metal cuts (holes, cuts and punch features)</li><li>• corner seams (seams and miters)</li><li>• flat patterns</li><li>• lofted flanges</li><li>• rips</li><li>• unfolding and refolding</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09220A Apply surface modelling techniques to 3-D drawings**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers preparing the 3-D computer-aided design (CAD) environment and application of surface modelling techniques to 3-D drawings.

## **Application of the Unit**

This unit is suitable for those working within a drafting work environment and may be applied across a range of engineering disciplines. This unit applies to the application of surface modelling techniques using CAD modelling software for computer processing and presentation purposes.

This unit includes applications in CAD, computer graphics and part geometric design, finite element mesh generation, rapid prototyping, medical testing and visualisation of scientific research.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM09002B Interpret technical drawing

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

## **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Determine surface modelling requirements | 1.1 | Check purpose, scope and information requirements for surface modelling task  |
|   |  | 1.2 | Interpret available information relevant to project and work requirements, and identify and address further information needs |
|   |  | 1.3 | Identify and prepare equipment required to complete work  |
|   |  | 1.4 | Identify and apply relevant codes, standards and symbols relevant to work   |
|   |  | 1.5 | Consult appropriate personnel to ensure the work is coordinated effectively with others involved in the project               |
|   |  | 1.6 | Obtain and apply workplace occupational health and safety (OHS) and environmental procedures for work                         |
|   |  |     |   |
| 2 | Perform surface modelling                | 2.1 | Prepare 3-D environment for drawing work  |
|   |  | 2.2 | Identify surface types, analyse surface data and prepare drawing for surface modelling  |
|   |  | 2.3 | Determine key features of surface modelling software package and select methodology appropriate for task                      |
|   |  | 2.4 | Set up and apply wire frame modelling techniques  |
|   |  | 2.5 | Set up and apply surface modelling techniques   |
|   |  | 2.6 | Edit and manipulate surfaces and apply rendering techniques   |

		2.7	Exploit surface modelling software to optimise productivity
3	Prepare views and annotations	3.1	Display isometric and orthographic perspectives
		3.2	Extract properties from the surface model
		3.3	Annotate drawing and complete required documentation
4	Complete CAD operations	4.1	Confirm drawing accurately reflects specifications, is presented according to work requirements and contains all relevant information
		4.2	Save and file drawing elements according to organisational procedures
		4.3	Prepare drawings for presentation
		4.4	Evaluate work and identify areas for improvement
		4.5	Close applications, perform CAD housekeeping and maintain organisational filing system

## Required Skills and Knowledge

### Required skills

Required skills include:

- obtaining relevant job instructions and specifications
- creating and manipulating surfaces in 3-D space
- saving drawing files in the appropriate format
- extracting the physical properties of shapes and surfaces created in 3-D space
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- applying rendering techniques to a 3-D model
- using various materials and surface finish options

## Required knowledge

Required knowledge includes:

- purpose for which the model is to be used
- principle tools used in the creation and manipulation of model surfaces
- terminology associated with surface modelling
- features and uses of geometric, freeform and derived surfaces
- features and uses of wire frame and surface modelling techniques
- surface types
- features and uses of rendering techniques
- features and uses of materials and surface finishing options
- number of views required
- CAD software features
- procedures for creating ruled and revolved surfaces in 3-D space
- applications of ruled and revolved surfaces
- rendering types and preferences, render lighting techniques, views and scenes
- procedures for saving drawing files
- the various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures for extracting data with respect to the physical properties of shapes and surfaces created in 3-D space
- hazard and control measures associated with using CAD system, including housekeeping
- safe work practices and procedures
- terminology associated with surface modelling

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply surface modelling techniques to 3-D models using CAD systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p>

	<ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• select and use 3-D CAD software to apply surface modelling techniques that meet design specifications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 3-D models using CAD systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Wire frame modelling techniques</b>	<p>Wire frame modelling techniques may include:</p> <ul style="list-style-type: none"> <li>• setting and using work planes</li> <li>• shifting and working with coordinate system</li> <li>• moving through 3-D space</li> <li>• changing 'Z' depth</li> <li>• construction techniques</li> <li>• wire frame editing</li> </ul>
<b>Surface modelling techniques</b>	<p>Surface modelling techniques may include:</p> <ul style="list-style-type: none"> <li>• definition and use of surface primitives</li> <li>• box, cylinder, cone, torus, wedge and editing surface primitives</li> </ul>
<b>Surface types</b>	<p>Surface types may include:</p> <ul style="list-style-type: none"> <li>• geometric, freeform and derived surfaces</li> <li>• draft, revolved, ruled, lofted, swept, coons, offset trimmed, fillet, blend, parametric and Non-Uniform Rational B-Spline (NURBS) surfaces</li> <li>• surface normals and reversing</li> </ul>
<b>Rendering techniques</b>	<p>Rendering techniques may include:</p> <ul style="list-style-type: none"> <li>• rendering types and preferences</li> <li>• render lighting techniques</li> <li>• views and scenes</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• site engineer</li> <li>• trainer</li> <li>• mentor</li> <li>• teacher</li> <li>• team member</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• personal protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> </ul>

	<ul style="list-style-type: none"><li>• awards provisions</li><li>• safe work practices</li></ul>
<b>Environmental requirements</b>	Environmental requirements may refer to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, and smoke emissions, including fugitive emissions</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
<b>Resource requirements</b>	Resource requirements may include: <ul style="list-style-type: none"><li>• computer software</li><li>• stationary</li><li>• software reference documentation</li><li>• reference texts</li><li>• consumables</li><li>• computer</li><li>• printing equipment</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM09221A Create 3-D model assemblies using computer-aided design (CAD) system**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers preparing the 3-D computer-aided design/drafting (CAD) environment, creating and modifying 3-D model assemblies and producing output to inform manufacture or assembly.

### **Application of the Unit**

This unit is suitable for those working within a drafting work environment and may be applied across a range of engineering disciplines. This unit applies to the production of 3-D assemblies using CAD modelling software. Operations at this level include, but are not limited to the use of library items; modelling techniques to represent engineering components and standard parts, such as bearings, seals, gears and fasteners; editing and production of 2-D manufacturing drawings with section views. Work also includes extraction of properties and application of basic rendering techniques.

This unit includes applications in CAD, computer graphics and animation, rapid prototyping, medical testing and visualisation of scientific research.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM09002B Interpret technical drawing

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine assembly modelling requirements	1.1	Check purpose, scope and information requirements for assembly modelling task
		1.2	Interpret available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify and prepare equipment required to complete work
		1.4	Identify and apply relevant codes, standards and symbols relevant to work
		1.5	Consult appropriate personnel to ensure the work is coordinated effectively with others involved in the project
		1.6	Obtain and apply workplace occupational health and safety (OHS) and environmental procedures for work
2	Prepare 3-D environment	2.1	Set up a 3-D environment on the screen to allow multiple viewing
		2.2	Create 3-D views on the screen by manipulating drawing planes and inserting 3-D geometric shapes
		2.3	Establish coordinate system and orientation according to job requirements
		2.4	Determine key features of assembly modelling software package and select methodology appropriate for assembly task
		2.5	Create individual components within the assembly using adaptive technology



		2.6	Access library items, as required, to create assemblies
3	Produce output from 3-D assembly model	3.1	Perform drawing for assembly modelling
		3.2	Exploit features of assembly modelling software to optimise productivity
		3.3	Extract physical properties to job requirement, including volume, mass and centre of gravity
		3.4	Edit solid models of components and assemblies
		3.5	Apply rendering techniques
4	Complete CAD operations	4.1	Confirm model accurately reflects specifications, is presented according to work requirements and contains all relevant information
		4.2	Save and file drawing elements according to organisational procedures
		4.3	Produce 2-D manufacturing drawings from the assembly models incorporating section views with all necessary annotation
		4.4	Evaluate work and identify areas for improvement
		4.5	Close applications, perform CAD housekeeping and maintain organisational filing system

## Required Skills and Knowledge

### Required skills

Required skills include:

- obtaining relevant job instructions and specifications
- creating the appropriate entities in 3-D space
- manipulating the entities in 3-D space
- modifying, where appropriate, existing 3-D models
- saving drawing files in the appropriate format
- extracting the physical properties of shapes created in 3-D space from the drawing file to

meet job requirements

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- creating intelligent models using parametric modelling
- using pre-drawn library files to produce assemblies
- extracting mass and area properties from solid model
- applying rendering techniques to a 3-D model
- using various materials and surface finish options.
- producing hard copies of 3-D solid models
- saving 3-D models in various file formats for retrieval into other CAD application software

### **Required knowledge**

Required knowledge includes:

- purpose for which the 3-D assembly model is to be developed
- principle tools used in the creation and manipulation of assembly models
- appropriate coordinate system for the job
- reasons for selecting the chosen coordinate system
- orientation of the model with respect to the coordinate system
- number of views required to establish the model
- top down and bottom up modelling techniques
- procedures for creating entities and components in 3-D space
- the entities that can be created/manipulated in 3-D space
- procedures for manipulating entities in 3-D space
- rendering types and preferences, render lighting techniques, views and scenes
- procedures for modifying existing 3-D assembly models
- procedures for saving drawing files
- the various formats in which drawing files can be saved
- reasons for using different formats when saving drawing files
- procedures for extracting data with respect to the physical properties of shapes created in 3-D space
- the physical properties of shapes created in 3-D space that can be extracted from the drawing file
- hazard and control measures associated with using CAD system, including housekeeping
- safe work practices and procedures
- terminology associated with solid assembly modelling

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to create 3-D model assemblies using CAD systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"><li>• work within typical site/teamwork structures and methods</li><li>• apply worksite communication procedures</li><li>• comply with organisational policies and procedures, including quality requirements</li><li>• participate in work meetings</li><li>• comply with quality requirements</li><li>• use industry terminology</li><li>• apply appropriate safety procedures</li><li>• select and use 3-D CAD software to create solid model assemblies that meet design specifications.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with creating 3-D models using computer aided design systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>

<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
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## Range Statement

<b>Solid modelling assembly task</b>	<p>Solid modelling assembly task may include:</p> <ul style="list-style-type: none"> <li>• economic impact of design upon manufacturing</li> <li>• principles of design</li> <li>• engineering components and standard parts</li> <li>• edit solid models and assemblies</li> <li>• 2-D manufacturing drawings and annotation</li> <li>• 3-D printing of components and assemblies</li> <li>• rendering and use of colour on 3-D models and assemblies</li> <li>• production of hard copies of drawings for solid models, assemblies and orthogonal drawings</li> <li>• saving files for later retrieval</li> <li>• consolidation (e.g. project work)</li> <li>• parametric modelling</li> <li>• composite models</li> <li>• section models</li> <li>• library files and 3-D primitives</li> <li>• other relevant software packages for the production of 3-D models</li> <li>• 3-D printing of components and assemblies</li> </ul>
<b>Rendering techniques</b>	<p>Rendering techniques may include:</p> <ul style="list-style-type: none"> <li>• rendering types and preferences</li> <li>• render lighting techniques</li> <li>• views and scenes</li> </ul>

<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• site engineer</li><li>• trainer</li><li>• mentor</li><li>• teacher</li><li>• team member</li></ul>
<b>OHS requirements</b>	OHS requirements may include: <ul style="list-style-type: none"><li>• legislation</li><li>• personal protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• awards provisions</li><li>• safe work practices</li></ul>
<b>Environmental requirements</b>	Environmental requirements may refer to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, and smoke emissions, including fugitive emissions</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
<b>Resource requirements</b>	Resource requirements may include: <ul style="list-style-type: none"><li>• computer software</li><li>• stationary</li><li>• software reference documentation</li><li>• reference texts</li><li>• consumables</li><li>• computer</li><li>• printing equipment</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# **MEM09222A Interpret and maintain or restore original drawings**

## **Modification History**

Release 1 - New unit of competency

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify and interpret original drawings that contain historical information and/or dated presentation protocols, maintain or restore documents and convert information to contemporary formats, including to computer-aided design (CAD) files.

## **Application of the Unit**

This unit is suitable for those working within a drafting work environment. Drawings include blueprints and other hard copy originals that may be used to inform current assembly, detail or design information, or hold other historical value.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM30032A Produce basic engineering drawings

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Analyse document components                 | 1.1 | Identify the purpose and scope of drawing and application for current work needs   |
|   |   | 1.2 | Examine and interpret drawing protocols applied, symbols, version, origin and completeness of information provided, and identify and address further information needs |
|   |   | 1.3 | Examine condition of document and determine requirements for presentation, maintenance or restoration  |
|   |   | 1.4 | Identify and prepare equipment required to complete work   |
| 2 | Maintain or restore document                | 2.1 | Apply treatment or preservation techniques, as required, to restore or maintain document   |
|   |   | 2.2 | Ensure document details are updated and required storage and filing conditions are prepared  |
| 3 | Transfer data to CAD format, where required | 3.1 | Determine and verify dimensions and notations  |
|   |   | 3.2 | Select and prepare CAD software and work environment   |
|   |   | 3.3 | Apply standard drawing conventions and techniques according to work requirements   |
|   |   | 3.4 | Produce drawings using CAD that reflect detail provided in original drawing  |
| 4 | Complete drawing task                       | 4.1 | Check and confirm dimensions, angles and proportions   |
|   |   | 4.2 | Ensure drawing is presented according to organisational requirements and contains all relevant and accurate information  |
|   |   | 4.3 | Issue and file drawing according to workplace procedure  |
|   |   | 4.4 | Evaluate work and identify areas for improvement   |
|   |   | 4.5 | Plot or print the final drawing to a standard scale  |



## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read and interpret instructions and specifications for drawings work
- obtaining all relevant job requirements, data/information and specifications necessary to produce the drawing in accordance with workplace procedures
- planning and sequencing operations
- checking and clarifying task-related information
- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and conduct mathematical problem solving as required in the scope of this unit
- applying spatial principles to achieve scale and proportion
- applying manual drawing and sketching techniques including correct use of lines, angles and curves, symbols and drawing conventions
- using manual drafting equipment appropriate to the drawing and chosen restoration method, including:
  - t-square
  - drafting board
  - instruments
  - appropriate pens, inks, paper and pencils
- recording completed drawings in accordance with standard operating procedures
- treating, handling and storing the approved drawings in accordance with standard operating procedures

### Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing and historical methods used, including:
  - symbols and drawing presentation
  - measurement and tolerancing conventions
  - drawing conventions and construction techniques
  - use of drawing materials
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and occupational health and safety (OHS) issues associated with the tools and materials used for drawing
- quality assurance procedures

- principles of plane geometry:
  - geometric shapes
  - plane geometry
  - geometric construction
- drawing construction:
  - four centre method
  - ordinate method
  - sectioning isometric shapes
  - dimensions and notations
  - line types
- requirements and purpose of the drawing to be produced
- sources of relevant data/information
- timeframe for completion of drawings
- persons who can confirm drawing requirements
- treatment, preservation and storage requirements for old blueprints and drawings

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use interpret historical detail drawings and blueprints, restore or maintain, as required, and complete drawing to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles, using CAD tools.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> </ul>

	<ul style="list-style-type: none"> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• interpret work and specifications and use reference material to obtain required information for drawing work</li> <li>• produce a detailed engineering drawing to AS 1100.101–1992 Technical drawing – General principles, and according to work requirements</li> <li>• use CAD software.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards,</p>

	manuals and reference materials.
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## Range Statement

<b>Standard drawing conventions</b>	<p>Standard drawing conventions may include:</p> <ul style="list-style-type: none"> <li>• use of correct sectioning technique</li> <li>• identification of cutting plane</li> <li>• accurate line types</li> <li>• appropriate view positions</li> <li>• use of correct symbols</li> <li>• use of correct dimensioning technique</li> <li>• provision of suitable number of views</li> <li>• use of correct scales</li> <li>• neat presentation</li> </ul>
<b>Drawing techniques</b>	<p>Drawing techniques may include:</p> <ul style="list-style-type: none"> <li>• orthogonal projection: <ul style="list-style-type: none"> <li>• first angle projection</li> <li>• third angle projection</li> <li>• projection symbol</li> <li>• preferred system of projection in Australia</li> <li>• number of views</li> <li>• relationship of views</li> </ul> </li> <li>• sheet format: <ul style="list-style-type: none"> <li>• borders and title blocks</li> <li>• application of projection symbol</li> <li>• drawing sheets and sizes</li> <li>• lettering styles</li> <li>• Australian Standards</li> </ul> </li> <li>• dimensioning: <ul style="list-style-type: none"> <li>• unidirectional dimensioning</li> <li>• aligned dimensioning</li> <li>• projection and dimension lines</li> <li>• arrow heads</li> <li>• dimension placement</li> </ul> </li> <li>• scale drawing: <ul style="list-style-type: none"> <li>• recommended scales</li> <li>• reduction scales</li> <li>• enlargement scales</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• multiple scales</li><li>• dimensioning techniques of scale drawings</li><li>• sectioning:<ul style="list-style-type: none"><li>• types of sections</li><li>• required section views</li><li>• placement of views</li><li>• cutting planes</li><li>• labelling of cutting planes and section views</li></ul></li><li>• general notes</li></ul>
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## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM10001C Erect structures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers inspecting and preparing the erection site and erecting structures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to structures that are predominantly steel and/or other metals. Structures covered by this unit are exclusively/predominantly metal structures and are load-bearing structures of substantial size.</p> <p>Where workshop assembly techniques are required, see Unit MEM05011D (Assemble fabricated components). Specifications for the structure would be supplied via engineering drawings or the like and would include site location information.</p> <p>Where lifting or rigging skills are required, appropriate units should be accessed. Where design skills are required, refer to Unit MEM09011B (Apply basic engineering design concepts).</p> <p>Where welds are required to meet legislative or regulating requirements, then appropriate welding units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05007C	Perform manual heating and thermal cutting
	MEM05012C	Perform routine manual metal arc welding
	MEM05015D	Weld using manual metal arc welding process
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
<b>Path 2</b>	MEM05007C	Perform manual heating and thermal cutting
	MEM05017D	Weld using gas metal arc welding process
	MEM05050B	Perform routine gas metal arc welding
	MEM05051A	Select welding processes
	MEM05052A	Apply safe welding practices
	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare erection site	1.1.Site is checked for correct location, dimensions and levels. 1.2.Non-compliance with specifications is reported to appropriate authority. 1.3.Minor alterations, corrections or adjustments are undertaken with approval of appropriate authority. 1.4.All surfaces and materials/components are prepared for use. 1.5.Structure components are identified and checked against specifications.
2. Erect structures	2.1.All work is carried out safely and in accordance with defined procedures.



ELEMENT	PERFORMANCE CRITERIA
	<p>2.2. Structure components are prepared for correct sequential erection.</p> <p>2.3. Components are erected and fixed according to specifications.</p> <p>2.4. Structures are adjusted to specifications.</p> <p>2.5. All reports and documentation are completed correctly to required specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- inspecting sites
- using measurement equipment within the scope of this unit
- undertaking numerical operations and calculations within the scope of this unit
- using tools and equipment associated with erecting structures
- checking and clarifying task-related information
- communicating and liaising with appropriate authorities
- planning job and site preparation
- preparing site
- handling materials
- inspecting materials/structure
- interpreting drawings, plans and specifications
- making authorised alterations, corrections or adjustments to the site and/or structure
- completing reports and documentation

#### Required knowledge

Look for evidence that confirms knowledge of:

- site management requirements
- site preparation and levelling requirements
- range of technique/equipment which can be used to check the site levels
- procedures to be followed if the location, dimensions and/or levels of the site do not comply with specifications

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for making alterations/corrections
- methods/techniques for a range of alterations/corrections
- legislative and regulatory guidelines
- materials applications, properties and characteristics
- materials specifications
- the procedures for checking the components of the structure
- correct erection sequence
- methods and selection of fixing/fastening the components of the structure
- methods and selection of lifting/moving the components of the structure
- methods and selection of locating/holding the components
- procedures for checking the structure for conformance
- procedures to be followed if the structure does not comply
- adjustments which can be made to bring the structure into specification
- approval process for final alterations
- required documentation
- reporting procedures
- hazards and control measures associated with erecting structures
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to inspect and ensure compliance of erection site and erect structures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assembly and erection of structures or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Site</b>	Onsite or offsite locations not covered by Unit 5.11A (Assemble fabricated components)
<b>Levels</b>	Straightforward levelling and alignment using plumb bob/lines, levels etc.
<b>Appropriate authority</b>	Site supervisor, building inspector, contractor, etc.
<b>Materials/components</b>	Ferrous and non-ferrous materials of a: <ul style="list-style-type: none"> <li>• variety of material sizes</li> <li>• variety of borne loads</li> <li>• variety of joining systems</li> <li>• variety of component profiles</li> </ul>
<b>Prepared</b>	<ul style="list-style-type: none"> <li>• Cleaning</li> <li>• Assembly sequencing</li> <li>• Surface finishing</li> </ul>
<b>Structures</b>	Metal frameworks, portals, stairways, walkways, vessels, tanks, platforms, conveyors and moving lines etc., including associated railings
<b>Reports and documentation</b>	<ul style="list-style-type: none"> <li>• Contract documents</li> <li>• Building inspection documentation</li> <li>• Compliance reports</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Installation and commissioning
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## MEM10002B Terminate and connect electrical wiring

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers terminating, disconnecting or reconnecting electrical wiring and circuits.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the connection of wiring and includes termination and connection of all types of cords and cables, excluding specialist cables.</p> <p>All testing is undertaken on completed circuits where these are not connected to main supply, using appropriate methods such as continuity and resistance checks.</p> <p>Specifications are obtained from electrical/electronic circuit drawings and data sheets.</p> <p>Soldering/desoldering of electrical/electronic components may also require the selection of Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components) or Unit MEM05002B (Perform high reliability soldering and desoldering) as applicable.</p> <p>This unit does not cover the competencies required for energising and testing of the circuit. If these skills are required, the competencies covered in Unit MEM10003B (Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.) must be satisfied.</p> <p>Termination and connection of specialist cables such as mineral insulated, steel wire, armoured cables etc., is covered in Unit MEM10011B (Terminate and connect specialist cables).</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 3</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for electrical wiring termination and connection	<p>1.1.All work is undertaken safely and to workplace procedures and State/Territory regulations and legislative requirements.</p> <p>1.2.Materials are checked for correct specifications.</p> <p>1.3.Preparation of work is undertaken or checked/inspected for correct location and specifications.</p>
2. Connect electrical wiring	<p>2.1.Terminations/connections are made to specifications, manufacturers' requirements and to safety and State/Territory regulations and legislative requirements.</p> <p>2.2.All brackets, clamps, holders etc. are adjusted and fixed to specifications.</p> <p>2.3.All cables, wires, conductors and connections etc. are marked/tagged and labelled to specification.</p> <p>2.4.All completed wiring and connections are tested for compliance with specifications.</p> <p>2.5.All reports and documentation are completed correctly to required specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- checking materials for conformance to specifications
- checking existing and new installation site for correct location and specification
- making terminations/connections to specification, manufacturer and regulatory requirements
- adjusting and fixing wiring supports
- marking, tagging and labelling cables, wires, conductors and connections to specification
- undertaking testing of wiring and connections for conformance to specification
- using language and literacy skills to complete short reports and required



**REQUIRED SKILLS AND KNOWLEDGE**

documentation

- reading and interpreting routine information on written job instructions, specifications and standard operating procedures May include drawings
- using measurements for checking connections and components

**Required knowledge**

Look for evidence that confirms knowledge of:

- safety hazards associated with the termination and connection of electrical wiring
- statutory and regulatory requirements associated with the termination and connection of electrical wiring
- wiring support and/or protection requirements and specifications
- relevant manufacturer requirements
- specifications and methods for terminating different materials
- wiring support techniques and alternatives
- marking, tagging and labelling requirements for cables, wires, conductors and connections
- tests for wiring and connections
- data to be recorded/reported and the frequency of recording/reporting
- requirements for approval to work
- use and application of personal protective equipment for terminating and connecting electrical wiring

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to terminate and connect electrical wiring. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with terminating and connecting electrical wiring or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>State/Territory regulations and legislative requirements</b>	Applicable acts, regulations, codes of practice, Australian standards, International standards
<b>Correct location and specifications</b>	Cable trays, brackets, trenches
<b>Electrical wiring</b>	Wiring associated with power, lighting, control wiring, machinery, switchboards and other electrical apparatus
<b>Terminations/connections</b>	Utilisation of a range of methods including clamping, crimping, pin connection, soldered joints, plugs, sockets etc., clamping of cables and wires, sealing entry points where required

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Installation and commissioning
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## MEM10003B Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing and testing electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installation of electrical wiring/systems and/or enclosures, including specialist cables, using the full range of installation materials and techniques to any wiring circuits which are directly or indirectly connected to a power supply system. The scope of work includes electrical installation work and electrical equipment work.</p> <p>Specifications/regulations and drawings can refer to legislative acts, SAA Wiring Rules Standards specifications, and electrical and architectural drawings.</p> <p>Where precision electrical/electronic measurement is required, see Unit MEM12004B (Perform precision electrical/electronic measurement).</p> <p>For specialist cables, Unit MEM10011B (Terminate and connect specialist cables) should be included.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment (up to 1000 volts a.c. and 1500 volts d.c.)

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan the installation	<p>1.1.Special work, hazard and safety requirements are determined and incorporated in plan.</p> <p>1.2.Work plan/strategy is devised and confirmed in accordance with legislative and regulatory requirements and standard operating procedures.</p>
2. Prepare for electrical installation	<p>2.1.All work is undertaken safely and to workplace procedures, State/Territory regulations and legislative requirements.</p> <p>2.2.Materials are checked for correct specifications.</p>
3. Install the wiring/enclosures and/or support systems	<p>3.1.All cables/conductors/conduit/enclosures and support systems are installed to specifications using correct appropriate techniques, tools and equipment.</p> <p>3.2.Cabling is marked or labelled for identification and to specification.</p>
4. Commission and test the installed wiring system	<p>4.1.All completed wiring/systems and enclosures are tested for compliance with specifications, regulations, and legislative requirements, utilising appropriate test procedures and equipment.</p> <p>4.2.Where appropriate, the installation may be energised and tested for compliance with specifications.</p> <p>4.3.Faults are rectified to specification.</p> <p>4.4.Documentation is completed correctly to required specifications.</p>
5. Perform emergency first aid	<p>5.1.Situation is assessed to identify points of danger to the injured person and potential rescuer, including the assessment of electrical hazards.</p> <p>5.2.Electrical hazards are isolated in accordance with established procedures for electrical rescue.</p> <p>5.3.Rescue/recovery of injured person, or assistance to injured person, is undertaken in accordance with recognised standards/procedures. Contact is made with appropriate medical and rescue authorities.</p> <p>5.4.Details of first aid given are recorded.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- interpreting circuits, drawings, specifications and instructions
- preparing work plans in accordance with legislative and regulatory requirements and standard operating procedures and hazard and safety requirements
- following relevant legislative and regulatory requirements and standard operating procedures to work practices
- using measurement for installing and testing electrical wiring and circuits
- checking materials for conformance to specification
- selecting cables
- installing cables/wires/conduit/enclosures and support systems
- marking and labelling cabling for identification
- testing wiring/systems and enclosures for compliance with specifications, relevant regulatory and legislative requirements
- energising and testing installation
- identifying and rectifying faults
- completing reports and documentation using short descriptions, comments and relevant terminology
- considering potential points of danger when planning a rescue or provision of assistance
- isolating electrical hazards in accordance with safety procedures
- applying procedures for the movement/treatment of injured, including:
  - clearing of airways
  - CPR (cardio-pulmonary resuscitation)
  - care of spinal injuries
  - treatment of cuts/lesions etc.
  - treatment of burns/scalds
  - treatment of shock
  - rescue from a live situation
- reading/interpreting specifications, test procedures, labelling, reference documentation and emergency first aid documents

### Required knowledge

Look for evidence that confirms knowledge of:

- hazard control measures and safety requirements applicable to the work undertaken
- work permit requirements
- safe work practices and procedures

## REQUIRED SKILLS AND KNOWLEDGE

- cable selection/support fit for purpose
- the legislative and regulatory requirements appropriate to the work to be done
- work planning procedures
- procedures to be followed if materials and or supports do not conform to specification
- techniques, tools and equipment required to install cables, wires, conduit, enclosures and support systems
- the marking and/or labelling requirements for cabling
- the reasons for marking and/or labelling cables
- the procedures and equipment to test before and after energising wiring and systems
- reasons for carrying out all tests
- common wiring system faults
- method(s) for rectifying faults
- the documentation to be completed
- dangers present in electrical rescue
- appropriate standards and procedures for first aid recording procedures
- recognised procedures for the movement and treatment of injured persons
- local medical and rescue services
- the reasons for recording first aid
- requirements for approval to work

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit will be able to install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency



<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing and testing electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c. or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating</p>

## RANGE STATEMENT

conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Installation</b>	Applies to electrical installation work and electrical equipment work. Involves utilisation of a range of methods, tools and equipment appropriate to the work
<b>Cables/conductors</b>	Single insulated, thermoplastic insulated and sheathed, flat and circular, MIMS, steel wire armoured, flexible cords and cables, copper and aluminium, catenary systems, shielded
<b>Conduit/enclosures</b>	Metallic and non-metallic
<b>Support systems</b>	Trunking, ducting, cable tray/ladder, catenaries
<b>Documentation</b>	Forms, short reports requiring comments etc., according to regulatory requirements

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Installation and commissioning
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## MEM10004B Enter and change programmable controller operational parameters

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers entering and changing programmable controller operational parameters, including specifications and procedures gained from a range of circuit drawings, engineering data sheets, step print out, manufacturers' procedure and data books.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work undertaken autonomously or as part of team environment using predetermined standards of quality, safety and workplace procedures. Work is generally undertaken at location of programmable controller but could be undertaken with data link offsite.</p> <p>Programmable controllers include PLC and DCS or similar devices.</p> <p>For routine downloading of PLC, robot, CNC or NC programs from disk, tape or direct means not requiring program or data adjustment or checks against specification, see Unit MEM16008A (Interact with computing technology).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM16008A	Interact with computing technology

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Install program	<p>1.1. Software is downloaded as required.</p> <p>1.2. Appropriate checks are undertaken during and after downloading to ensure data transfer is accurate and complete.</p>
2. Verify machine/system/ process operation	<p>2.1. Appropriate checks are undertaken after downloading to ensure machine operation or process output is accurate to specification.</p> <p>2.2. Specific problems in machine operation or process output being controlled by the programmable controller are identified in accordance with standard operating procedures.</p> <p>2.3. Specific changes required to operating parameters</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>within the software program are derived in accordance with standard operating procedures.</p> <p>2.4. Adjustments/changes are made to operating parameters in accordance with standard operating procedures.</p> <p>2.5. Final check of machine operation and/or process output are taken to ensure that they are in accordance with specifications.</p>
3. Report on changes	3.1. Changes and adjustments are reported in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting appropriate data transfer device(s)/procedure(s) and transferring the software accurately
- verifying machine operation or process output
- obtaining specific changes required to operating parameters within the software program
- adjusting/changing operational parameters
- checking machine operation or process output
- reporting
- identifying problems
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- appropriate and correct program loading techniques and reasons for selecting the chosen program loading technique
- checks to be undertaken during and after downloading
- reasons for checking that the data transfer is accurate and complete
- action to be taken if data transfer is inaccurate and/or incomplete
- specifications relating to the transferred data
- correct operation of the machine or process
- specific machine operations or process outputs being controlled by the programmable controller
- specific problems in accordance with standard operating procedures
- operating parameters within the software program
- standard operating procedures
- specification to be met and functions to be controlled and machine operation or process output
- reporting process
- procedures to change parameters and their implications
- hazard and control measures associated with entering and changing programmable controller operational parameters, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to enter and change programmable controller operational parameters. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with entering and changing programmable controller operational parameters or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and



<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Verify</b>	Verification of machine/process/system operation includes interpreting the program, excluding multi-loop and control sequencing programs.
<b>Standard operating procedures</b>	Industry standards, production schedules, material safety data sheets, work notes and plans, product labels, manufacturers' specifications, operator manuals, enterprise policies and procedures, supervisors' oral and written instructions, current State/Territory occupational health and safety legislation, standards and codes of practice.
<b>Operating parameters</b>	Includes timer, counter and set point settings. All specifications and procedures gained from a range of circuit drawings, engineering data sheets, step print out, manufacturers' procedure and data books

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Installation and commissioning
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## MEM10005B Commission programmable controller programs

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers adjusting and commissioning the programmable controller program to specification only.
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### Application of the Unit

<b>Application of the unit</b>	<p>All programmable controller programs include single and multi-loop programs and control sequencing of processes. Work is undertaken autonomously or as part of team environment using predetermined standards of quality, safety and workplace procedures.</p> <p>Work is undertaken on location.</p> <p>It is assumed that this unit will normally be accessed in conjunction with units of skill that relate to the operational processes controlled by the programmable controller. Programmable controllers include PLC and DCS or similar devices.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10004B	Enter and change programmable controller operational parameters
	MEM16008A	Interact with computing technology

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Commission programmable controller program	1.1. Program format and operational intent are determined and understood. 1.2. Program instructions are checked for compliance with specifications using appropriate techniques. 1.3. Software timers and counters are set to specifications where required. 1.4. Program is stepped through manually and outputs

ELEMENT	PERFORMANCE CRITERIA
	<p>are checked and measured for compliance with specifications.</p> <p>1.5. Where applicable, program is edited to meet specifications.</p> <p>1.6. External inputs are checked for compliance with specifications utilising correct and appropriate techniques.</p> <p>1.7. Where applicable, program is run and total operation is checked for compliance with specifications.</p> <p>1.8. Where applicable, final adjustments are undertaken to meet operational specifications using standard operational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant circuit drawings, ladder diagrams, engineering data sheets, manufacturers' procedures and data sheets
- complying with specifications and adjusting programs
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking external inputs for conformance to specification using appropriate techniques/equipment
- checking process operation, and editing and adjusting as required to ensure conformance to specification
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

## REQUIRED SKILLS AND KNOWLEDGE

- format of the program
- program specifications
- procedures and techniques for checking that program instructions comply with specifications
- procedures for dealing with any non-conformances with specifications
- procedures for setting software timers and counters
- function of software timers and counters
- procedures for manually stepping through the program
- checks that can be made of program outputs
- techniques to be used in checking program outputs
- measurements to be taken during the checking of program outputs
- instruments to be used to take measurements
- procedures for editing programs
- checks to be made to ensure that the external inputs comply with specifications
- techniques and equipment to be used in checking external inputs
- procedures for running the program
- specifications and operational processes controlled by the programmable logic controller
- techniques and equipment to be used to check the operational process
- adjustments that can be made to the program
- effects of adjustments on the operational processes controlled by the program
- procedures to be followed when adjusting programs
- hazards and control measures associated with commissioning programmable controller programs, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to commission programmable controller programs. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with commissioning programmable controller programs or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Specifications**

All specifications and procedures gained from circuit drawings, ladder diagrams, engineering data sheets, program print-out manufacturers' procedures and data books

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Installation and commissioning
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## MEM10006B Install machine/plant

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing machine/plant where the equipment being installed requires substantial modification to the existing site and/or connecting equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installation where the equipment being installed requires substantial modification to the existing site and/or connecting equipment, and excludes minor modifications. Installation covered by this unit also excludes electrical installation.</p> <p>Work is undertaken utilising new or existing external and internal locations and sites. Foundations, footings, beds and frameworks are completed prior to installation and commissioning. All specifications are applied via engineering drawings, written or verbal instructions.</p> <p>Routine modifications and alterations are of a minor nature not requiring specification changes or technical recording. Examples would be fitting of spacers, spool pieces, relocation of brackets, alignment of holes etc.</p> <p>Where existing machines/plant are replaced by the same or similar machine/plant, Unit MEM18006C (Repair and fit engineering components) applies.</p> <p>If balancing skills or manufacture of gaskets is required, these should be accessed from appropriate units. Where design skills are required, refer to Unit MEM09011B (Apply basic engineering design concepts).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18009B	Perform levelling and alignment of machines and engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold
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unit of competency.	italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare installation site	<p>1.1.Site is checked for correct location, dimension and levels etc. utilising appropriate measuring equipment.</p> <p>1.2.Non-compliance with specification is reported to appropriate authority.</p> <p>1.3.Alteration/correction is undertaken with approval of appropriate authority.</p> <p>1.4.All surfaces, materials and components are prepared for use.</p>
2. Install machine/plant	<p>2.1.All work is carried out safely and in accordance with site procedures and to Australian standards.</p> <p>2.2.Machine components are prepared for correct sequential installation.</p> <p>2.3.Machine/plant is installed in accordance with manufacturers' and site specifications.</p> <p>2.4.Routine modifications/alterations are undertaken to standard operating procedures where required.</p> <p>2.5.Machine/plant is levelled, aligned, coupled and connected (excluding electrical connections) in accordance with specifications.</p> <p>2.6.Site is cleaned and cleared of all debris and left in safe state.</p> <p>2.7.All reports and documentation are completed correctly to required specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

**REQUIRED SKILLS AND KNOWLEDGE****Required skills**

Look for evidence that confirms skills in:

- interpreting and following information on written job instructions, manufacturer specifications, standard operating procedures, charts, lists, reports and other applicable reference documents
- interpreting layout drawings and specifications
- checking and clarifying information
- orally reporting routine information
- planning and sequencing tasks
- locating and verifying site and levels for installation
- identifying non-compliances
- preparing surfaces prior to commencing the installation
- completing proformas, standard workplace forms, workplace reports and other applicable documents
- checking for conformance to specifications
- measuring to specified tolerances
- performing numerical operations, geometry and engineering calculations/formulae within unit's scope

**Required knowledge**

Look for evidence that confirms knowledge of:

- installation specification of the machine/plant
- procedures to follow if the location, dimensions and/or levels of the site do not comply with the specifications
- procedures for checking whether the installed machine/plant conforms to specifications
- materials and components to be used in the installation of the machine/plant
- applicable codes and standards
- installation sequence
- methods to locate, fix/fasten machine/plant
- methods of lifting/moving machine/plant and components
- techniques, tools and equipment to measure site and machine/plant installation
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with installing machine/plant, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to install machine/plant requiring substantial modification to the existing site and/or connecting equipment; excluding minor modifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing machine/plant or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Machine/plant**

Rotating equipment and machinery such as pumps, blowers, compressors, drive units, etc., production equipment and plant, process equipment, plant and machinery, engineering plant and machine tools etc.

**Routine modifications/alterations**

Fitting of spacers, relocation of brackets, alignment of holes etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Installation and commissioning
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## MEM10007C Modify control systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning the commissioning procedure, assessing the control system performance, adjusting the control system, and undertaking commissioning modifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work is generally undertaken in a team environment, but not exclusively.</p> <p>Control systems can mean closed or open loop on continuous or step process control systems. All specifications are supplied via engineering/circuit drawings, data sheets, written or verbal instructions.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical



Prerequisite units		
		wiring
	MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c./1500 volts d.c.
	MEM12002B	Perform electrical/electronic measurement
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18048B	Fault find and repair/rectify basic electrical circuits
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18051B	Fault find repair/rectify complex electrical circuits
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM14005A	Plan a complete activity
	MEM12002B	Perform electrical/electronic measurement
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations

Prerequisite units		
	MEM16006A	Organise and communicate information
	MEM16010B	Write reports
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18016B	Analyse plant and equipment condition monitoring results
	MEM18018B	Maintain pneumatic system components
	MEM18019B	Maintain pneumatic systems
	MEM18020B	Maintain hydraulic system components
	MEM18021B	Maintain hydraulic systems
	MEM18022B	Maintain fluid power controls
	MEM18023B	Modify fluid power system operation
	MEM18053B	Modify fluid power control systems
	MEM18055B	Dismantle, replace and assemble engineering components
<b>Path 3</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test, calibrate instrumentation systems, equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18067B	Tune control loops - multi controller or multi element systems
<b>Path 4</b>	MEM05001B	Manual soldering/desoldering - electrical/electronic components
	MEM05002B	Perform high reliability soldering and desoldering
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held

Prerequisite units		
		operations
	MEM18056B	Diagnose and repair analog equipment and components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18058C	Modify electronic equipment
	MEM18059B	Modify electronic systems
	MEM18065B	Diagnose and repair digital equipment and components
<b>Path 5</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18088B	Maintain and repair commercial air conditioning systems and components
	MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls
<b>Path 6</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements

Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18090B	Maintain and repair industrial refrigeration systems and components
	MEM18092B	Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls
<b>Path 7</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18089B	Maintain and repair central air handling systems
	MEM18090B	Maintain and repair industrial refrigeration systems and components
	MEM18093B	Maintain and repair integrated industrial refrigeration and/or large

Prerequisite units		
		air handling system controls
<b>Path 8</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test, calibrate instrumentation systems, equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18064B	Maintain instrumentation system components
	MEM18067B	Tune control loops - multi controller or multi element systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan commissioning procedure	<p>1.1. Control system format and operational intent is determined and understood.</p> <p>1.2. Commissioning procedures are effectively sequenced to meet requirement of components and control application.</p>
2. Check control system installation	<p>2.1. Correct installation of system components is verified against specifications.</p> <p>2.2. Appropriate test equipment is functional and calibrated before use.</p> <p>2.3. Components or control loop/system is powered up and checked for correct supply in accordance with specifications.</p> <p>2.4. All readings/measurements are correctly obtained, interpreted and recorded.</p>
3. Adjust control system and assess performance	<p>3.1. Control loop/system components are adjusted to meet control characteristics, application and process specifications utilising appropriate techniques.</p> <p>3.2. Final verifications including any operational adjustments are made to ensure required performance.</p>
4. Commission modifications	<p>4.1. Necessary modifications to change performance in order to meet manufacturers' or operational specifications or safety and legislative requirements are undertaken or actioned.</p> <p>4.2. Reports on system/process characteristics are provided for warranty, handover, legislative, etc. purposes.</p> <p>4.3. All modifications are documented and result is recorded to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- obtaining necessary approvals
- checking system components against specification
- calibrating and checking test equipment to be used
- energising and checking the components and/or the control loop/system for correct supply
- checking and clarifying task-related information
- adjusting control loop/system components
- conducting appropriate measurements/tests
- carrying out authorised modifications to the control system and/or process components
- checking for conformance to specifications
- completing reports and documentation on commissioning activity
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- work to be undertaken
- control system format
- operational intent of the processes being controlled by the control system
- specifications of the control system and the processes being controlled
- regulatory and legislative requirements associated with the commissioning procedure
- procedures for commissioning the control system
- procedures to ensure that control characteristics, application and process specifications are achieved
- components of the operational processes
- installation specifications for each component of the operational processes



**REQUIRED SKILLS AND KNOWLEDGE**

- measuring techniques and equipment appropriate to the measurements to be taken
- test equipment and techniques appropriate to the commissioning of the control
- calibration procedures for the selected test equipment
- procedures for energising components and/or the control loop/system
- supply requirements of components and the control loop/system
- recording requirements for readings/measurements taken
- adjustments that can be made to the control loop/system components
- effects of adjustments on the control characteristics and operational processes
- measurements/tests to be undertaken to verify control system and process operation
- reasons for selecting the chosen measurements/tests
- procedures to be followed if the operational specifications of the control system and/or process cannot be achieved
- effect of changes to control system components on system performance
- appropriate authority to approve any modifications
- reporting requirements associated with the commissioning of control systems
- requirements for recording modifications
- reasons for recording modifications
- hazard and control measures associated with modifying control systems, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to modify control systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modification of control systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Commissioning</b>	Commissioning involves the development of a commissioning procedure, testing of operation and adjustment to conform to specification
<b>Control system</b>	Control systems can mean closed or open loop on continuous or step process control systems. Loop/system control can incorporate the use of pneumatics, electrical, electronics, hydraulics or a combination
<b>System components</b>	Control loop/system components incorporate all instruments and devices which make up or control a loop/system, including sensing devices, control devices, actuators and transducers

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Installation and commissioning
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## MEM10008B Undertake commissioning procedures for plant and/or equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking commissioning work on internally or externally located plant and/or equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to commissioning work undertaken on internally or externally located plant and/or equipment that is new, or replaced, or has been extensively modified (by people usually outside of the commissioning individual or team).</p> <p>Technical difficulties are resolved in consultation with appropriate technical advisers. All work is undertaken to specifications supplied via engineering drawings and data sheets, written and verbal instructions, regulatory and legislative requirements.</p> <p>Additional specialisation units may be required for some specialist applications e.g. fluid power, instrumentation and PLC etc.</p> <p>This unit is not intended to be used by maintenance personnel completing their own work, including return to service work.</p> <p>These activities are covered in Unit MEM18004B (Maintain and overhaul mechanical equipment, and/or Unit MEM09011B (Apply basic engineering design concepts), and/or Unit MEM18006C (Repair and fit engineering components), and/or MEM18048B (Fault find and repair/rectify basic electrical circuits), and/or MEM18054B (Fault find, test and calibrate instrumentation systems and equipment).</p> <p>If reports are required, Unit MEM16010B (Write reports)</p>
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	should also be selected.
	<b>Band: B</b>
	<b>Unit Weight: 4</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10006B	Install machine/plant
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18009B	Perform levelling and alignment of machines and engineering components
	MEM18055B	Dismantle, replace and assemble engineering components
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements

Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18090B	Maintain and repair industrial refrigeration systems and components
<b>Path 3</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18089B	Maintain and repair central air handling systems
<b>Path 4</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements

Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c. and 1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan commissioning procedure	1.1.Commissioning procedure is undertaken and approvals are obtained in accordance with standard operating procedures.
2. Assess system performance	2.1.Correct measuring/test devices are used. 2.2.All necessary measurements/readings are taken at appropriate points.

ELEMENT	PERFORMANCE CRITERIA
	2.3.All variances from specifications are recorded to standard operating procedures.
3. Adjust plant	3.1.Plant/system performance is adjusted to design and operational specifications utilising appropriate and correct techniques. 3.2.Technical difficulties are resolved in consultation with appropriate technical advisers.
4. Make reports	4.1.Report/logs are produced on completed system/plant/machinery/status/performance as required in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining work approvals and permits
- selecting measuring/testing devices
- safely taking measurements/readings
- recording variations in machine/plant performance from specification
- making appropriate adjustments to machine/plant
- completing short reports using relevant technical terminology
- reading, interpreting and following information on written job instructions, specifications, manufacturer documents, commissioning procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- entering information onto standard workplace forms and reports
- checking for conformance to specifications
- using precision measurement equipment
- undertaking numerical operations and calculations/formulae within the scope of this unit

#### Required knowledge



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- the sequence of events in the commissioning of the machine/plant
- performance tests appropriate to the machine/plant to be commissioned
- measurements required to ensure conformance to specifications and correct points at which measurements are to be taken
- appropriate adjustments to bring the machine/plant into line with operational specifications based on engineering principles or appropriate technical advice
- reporting requirements relevant to the machine/plant being commissioned
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to undertake commissioning procedures for plant and/or equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with undertaking commissioning procedures for plant and/or equipment or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
Plant/system	Rotating equipment and machinery, production equipment, plant and machinery, process equipment, and machine tools etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Installation and commissioning
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# MEM10009B Install refrigeration and air conditioning plant and equipment

## Modification History

Prerequisite unit MEM05006B updated to MEM05006C

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing refrigeration/air conditioning systems in commercial, industrial, marine and transport applications.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to refrigeration/air conditioning systems in commercial, industrial, marine and transport applications - refer to field definitions.</p> <p>All work is to be undertaken in accordance with all relevant Commonwealth, State or Territory legislation and regulatory requirements.</p> <p>Modifications and alterations are of a minor nature and do not require specification changes or technical recording, for example, the fitting of spacers, relocation of brackets, alignment of holes, etc.</p> <p>Work is undertaken using new or existing internal or external locations and sites. Footings, foundations, beds and frameworks are completed prior to installation.</p> <p>Work is undertaken autonomously or in a team environment using predetermined standards of safety, quality and workshop procedures.</p> <p>This unit should not be selected with Unit MEM10006B (Install machine/plant).</p> <p>Where extensive fitting and alignment is required, then Unit MEM18006C (Repair and fit engineering components) and Unit MEM18009B (Perform levelling and alignment of machines and engineering components) should also be selected.</p> <p>Where modifications involve electrical disconnection and</p>
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	reconnection, then Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.) should also be selected.  <b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM09002B	Interpret technical drawing
	MEM10010B	Install pipework and pipework assemblies
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare installation site	<ul style="list-style-type: none"><li>1.1.Site is checked for correct location, dimension and levels, etc. using appropriate measuring equipment and standard refrigeration/air conditioning practices.</li><li>1.2.Non-compliance with specification is reported to appropriate authority.</li><li>1.3.Alteration/correction is undertaken with approval of appropriate authority.</li><li>1.4.All surfaces, materials and components are prepared for use.</li></ul>
2. Install refrigeration/air conditioning plant and equipment	<ul style="list-style-type: none"><li>2.1.All work is carried out safely and in accordance with site procedures and to relevant standards.</li><li>2.2.Refrigeration/air conditioning plant and equipment/components are organised for correct sequential installation.</li><li>2.3.Refrigeration/air conditioning plant and equipment/components are installed in conformance with manufacturers' and site specifications.</li><li>2.4.Routine modifications/alterations of the refrigeration/air conditioning plant and equipment are undertaken to standard operating procedures where required.</li><li>2.5.Refrigeration/air conditioning plant and equipment are levelled, aligned, coupled and connected in accordance with specifications.</li><li>2.6.The refrigeration system is charged with refrigerant and lubricant in accordance with standard operating</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	procedures. 2.7.The site is cleaned and cleared of all debris and left in a safe state.
3. Start up refrigeration/air conditioning plant and equipment and check operation	3.1.Start-up procedure is developed for the refrigeration/air conditioning plant and equipment. 3.2.The refrigeration/air conditioning plant and equipment is operated and assessed for conformance to specification. 3.3.Non-conformances and system faults are identified, and appropriate action/adjustments are taken to specification. 3.4.All reports and documentation are completed correctly to required specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking the site for correct location, dimensions and levels
- detecting and reporting non-conformance to specifications
- preparing surfaces for installation
- checking for conformance to specifications
- preparing plant for start-up
- adjusting refrigeration plant and equipment
- using appropriate tools, techniques and equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- procedures for non-compliances

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for checking the refrigeration/air conditioning plant and associated equipment
- procedures for making alterations, corrections or adjustments to the refrigeration/air conditioning plant and associated equipment
- correct sequential installation of all components
- methods of fixing/fastening and locating/holding the components
- procedures for checking refrigeration systems for leaks
- procedures for checking refrigeration/air conditioning plant and associated equipment prior to start-up
- procedures for adjusting the refrigeration/air conditioning plant and associated equipment to specification
- codes and regulations relevant to the refrigeration/air conditioning industry including environmental and ozone and greenhouse substance legislation
- hazards and control measures associated with installing refrigeration and/or air conditioning plant and associated equipment, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to install refrigeration and air conditioning plant and equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic



**EVIDENCE GUIDE**

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing refrigeration and air conditioning plant and equipment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Measuring equipment**

Lasers, dumpy levels etc.

**Relevant standards**

- Australian standards
- Building codes

RANGE STATEMENT	
	<ul style="list-style-type: none"><li>• Air conditioning/refrigeration standards</li><li>• Local authority standards</li><li>• Environmental standards</li><li>• Greenhouse emission regulations</li></ul>
<b>Refrigeration/air conditioning plant and equipment/components</b>	Compressors, evaporators, condensers, valves, controllers, fans, solenoids, sensors, thermostats, switches, recorders, etc.
<b>Appropriate action</b>	In accordance with urgency requirements to address equipment failure and/or personnel danger

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Installation and commissioning
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## MEM10010B Install pipework and pipework assemblies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning, preparing and installing pipework and assemblies.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installation of ferrous and non-ferrous pipes and fittings. Where pipework is to be cut by mechanical or thermal methods, or where welding processes are used, the appropriate unit(s) should be selected.</p> <p>Pipework and installation is performed to established practices and standards.</p> <p>Where the pipework is to be formed and shaped using mechanical and/or thermal techniques, Unit MEM05010C (Undertake fabrication, forming, bending and shaping), should be selected.</p> <p>Where pipework and assemblies are to be part of a system/process covered by legislative/regulatory requirements, units relating to the appropriate welding certificates for the pipe material and application must also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan the installation of pipework and pipework assemblies	<p>1.1.Quantity and type of pipework and pipework assemblies are selected according to specifications.</p> <p>1.2.The appropriate sequence for the installation of pipework and pipework assemblies is determined according to the installation type and specifications and other applicable factors.</p>

ELEMENT	PERFORMANCE CRITERIA
	1.3.The work area is prepared for installation of pipework and pipework assemblies.
2. Prepare pipework and pipework assemblies for assembly	2.1.Pipework is cleaned to standard operating procedures. 2.2.Pipework and assemblies are purged to standard operating procedures. 2.3.Pipework and assemblies are capped/sealed.
3. Install pipework and assemblies	3.1.Enclosures/hangers/support systems are installed without damage or distortion to the surrounding environment or other services. 3.2.Pipework and assemblies are installed without damage or distortion to pipework, assemblies or surrounding environment or other services. 3.3.Pipework is leak tested to standard operating procedures. 3.4.All ancillary devices and materials are installed to specification according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting and following information on specifications, standard operating procedures and other applicable reference documents
- planning and sequencing installation
- preparing the site
- preparing joining surfaces
- purging pipework and assembly
- capping and sealing pipework and assembly
- installing enclosure/hanging /supporting assemblies
- assembling and installing pipework and ancillaries
- testing installed pipework and rectifying leaks

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- installation techniques
- site and safety requirements
- cleaning procedures and the applications and precautions for using solvents/cleaning material
- purging techniques, applications and precautions
- capping/sealing pipework and assembly methods
- identification of location/layout of pipework and assemblies and application and characteristics of enclosure/hanging/supporting systems
- pipework, ancillary installation and joining procedures
- leak testing applications and uses
- regulations and legislative requirements
- hazards and control measures
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to install pipework and pipework assemblies in accordance with standard operating procedures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must

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	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing pipework and pipework assemblies or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Pipework and pipework assemblies**

- Ferrous, non-ferrous, plastic, etc.
- Variety of sizes and or wall thickness
- Variety of joining systems such as collars,

<b>RANGE STATEMENT</b>	
	unions, flanges, etc.
<b>Enclosures</b>	Metal and PVC
<b>Hangers and support systems</b>	Pipe/tube bundle support, ties, unistrut, trays, ladder racks, ducts etc.
<b>Leak test</b>	Soapy water, water immersion, compressed air
<b>Ancillary devices and materials</b>	Insulation materials, valve control systems, etc.
<b>Legislation and regulations</b>	Building regulations, gas/fluid pipeline regulations

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Installation and commissioning
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## MEM10011B Terminate and connect specialist cables

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing for the termination and connection of specialist cables.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the connection of specialist cables including, but not confined to:</p> <ul style="list-style-type: none"><li>• mineral insulate cables (MIMS)</li><li>• steel wire armoured cables (SWA)</li><li>• other sheathed cables such as piloted cables, composite screened cables, braided cables</li><li>• cable installations requiring specialised glands, fittings and enclosures</li></ul> <p>Termination and connection requires particular techniques, and, in some cases testing.</p> <p>All testing is undertaken on completed circuits where not connected to main supply using appropriate methods e.g. continuity and resistance checks.</p> <p>Special fittings must be used for each type of specialist cable. Cables may require the use of bending tools and techniques which do not cause damage. Compounds such as resins may be required for sealing purposes.</p> <p>Most types of specialist cables are designed to either exclude or minimise the ingress of gas or liquids, or to minimise the danger of flash.</p> <p>For termination and connection of signal and data cables, Unit MEM18063B (Terminate signal and data cables) should be selected.</p> <p>For termination and connection of standard electrical wiring/cable, refer to Unit MEM10002B (Terminate and</p>
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	connect electrical wiring)
	<b>Band: A</b>
	<b>Unit Weight: 3</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for termination and connection of specialist cables	<p>1.1.All work is undertaken safely and to workplace procedures, applicable regulations and legislative requirements.</p> <p>1.2.Correct cables and materials are selected in accordance with job requirements.</p> <p>1.3.Certification documentation is obtained where appropriate.</p> <p>1.4.Preparation of work is undertaken or checked/inspected for correct locations and specifications.</p>
2. Connect specialist cables	<p>2.1.Terminations/connections are made to specifications, manufacturers' requirements and to safety and State/Territory regulations and legislative requirements.</p> <p>2.2.Equipment and wiring are installed in a manner that does not reduce the type of protection afforded by the equipment design.</p> <p>2.3.All cabling, connections and terminations are tested for compliance with specifications.</p> <p>2.4.All cables, wires, conductors and connections are marked/tagged and labelled to specifications.</p> <p>2.5.Documentation is completed correctly in accordance with relevant specifications and regulatory requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- checking cables and materials for condition and conformance to specifications
- obtaining and interpreting appropriate documentation
- making terminations/connections to specification, manufacturer and regulatory requirements
- testing cabling, connections and terminations
- marking, tagging and labelling cables, wires, conductors and connections
- entering information onto documentation related to termination and connection of specialist cables
- applying measurement skills needed to meet the requirements of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- work site procedures and relevant statutory requirements
- safety hazards associated with the termination and connection of cables, and the work environment
- statutory requirements associated with the termination and connection of specialist cables
- specifications for specialist cables and materials
- requirements for approval to work
- wiring support and/or protection requirements
- specifications of wiring support and/or protection requirements
- applicable statutory requirements
- reading and interpreting relevant drawings, instructions and reference documents
- manufacturer requirements
- testing methods for specialist cables including continuity and resistance testing
- marking, tagging and labelling requirements for cables, wires, conductors and connections
- data to be recorded/reported and the frequency of recording/reporting.
- the impact of the site and location variables may have on termination and connection
- use and application of personal protective equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

**EVIDENCE GUIDE**

performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to terminate and connect specialist cables including, but not confined to: mineral insulate cables (MIMS); steel wire armoured cables (SWA); other sheathed cables such as piloted cables; composite screened cables, braided cables; and cable installations requiring specialised glands, fittings and enclosures.

Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with terminating and connecting specialist cables or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
Documentation	Short record of termination or test results
Tested	Continuity and resistance testing

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Installation and commissioning
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## MEM10013A Install split air conditioning systems and associated pipework

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing split air conditioning systems to relevant standards, codes and local regulations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency unit is limited to split air conditioning applications only.</p> <p>The unit includes safe working practice and following standard procedures and manufacturer instructions to install split air conditioning equipment.</p> <p>For commissioning and decommissioning of split air conditioning systems unit MEM18084A should also be selected.</p> <p>This unit refers to plug in applications only. Where the installation and connection to mains supply of fixed wiring is necessary then this work must be undertaken by a suitably licensed person</p> <p>Persons competent in and undertaking work covered by this unit are required to hold the national restricted split system installation and decommissioning license.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM05006C	Perform brazing and/or silver soldering
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate split air	1.1.Required split air conditioning unit, piping and other

ELEMENT	PERFORMANCE CRITERIA
conditioning components	<p>components are identified from job and manufacturer specifications and diagrams.</p> <p>1.2.The location of unit components, piping and drains is determined in consultation with customer and other site considerations.</p> <p>1.3.Industry and local authority requirements, standards and codes and manufacturer requirements are identified including the appropriate capacity rating of the equipment and any impacts on the installation are identified.</p>
2. Inspect and prepare installation sites	<p>2.1.All work is carried out safely to Australian Standards, state and local codes and regulations.</p> <p>2.2.The installation site is prepared as appropriate to industry codes of practice and manufacturer installation instructions.</p> <p>2.3.The work is carried out without damage to the system, components and the surrounding environment or services.</p>
3. Prepare split system equipment and materials for installation	<p>3.1.Safety hazards are identified and noted and established risk control measures are implemented.</p> <p>3.2.Appropriate personnel are consulted to ensure the work is coordinated effectively with others involved on the work site.</p> <p>3.3.All components, piping and fittings are properly checked for conformance to manufacturer specification, job requirements and applicable standards.The layout of the pipe work is determined from job specifications and diagrams.</p> <p>3.4.Materials needed to carry out the work are obtained in accordance with established procedures and checked against job requirements.</p> <p>3.5.Tools, equipment and testing devices needed to conduct the work are obtained in accordance with established procedures and checked for correct operation and safety.</p> <p>3.6.Preparatory work is checked to ensure no damage has occurred and that it complies with work requirements.</p>
4. Prepare and install refrigerant pipework	<p>4.1.Safe work practices/risk control measures are applied as required.</p> <p>4.2.Tools and equipment are used safely and in accordance with manufacturer instructions.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>4.3. Pipework is prepared and joined to required specification with minimal wastage and damage/contamination to environment.</p> <p>4.4. Pipework and fittings are joined using appropriate pipe joining methods.</p> <p>4.5. Pipes are run separately and insulated according to manufacturer instructions and to relevant standards codes and regulations.</p> <p>4.6. Pipework and joins are checked for compliance and integrity using appropriate testing methods.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, confirming and following information on written job instructions, manufacturer specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- identifying hazards and applying safe work practices and risk control measures
- planning the installation, sequencing and coordinating work activities
- applying skills and knowledge to solve problems, deal with contingencies and unexpected events
- communicating with appropriate persons such as customer, supplier, electrical contractor
- adapting to the demands and considerations of the work environment
- sourcing components using relevant catalogues/lists
- positioning components for installation
- preparing the installation site
- checking and using applicable tools and equipment
- identifying split system air conditioning components, piping, fittings and consumables
- fabricating and joining pipework
- assembling and fixing system components
- checking pipework and units for compliance to specification
- documenting the installation and work activities

**REQUIRED SKILLS AND KNOWLEDGE****Required knowledge**

Look for evidence that confirms knowledge of:

- basic vapour compression cycle operating principles
- basic reverse cycle operating principles
- layouts, siting and set-ups of split air conditioning systems
- typical work environment, demands and considerations
- effective communication with appropriate persons
- typical problems, contingencies and solutions
- components, accessories and fixtures for split air conditioning systems
- considerations for siting units and components
- techniques and processes for site preparation
- fixing methods tools and equipment for system components and pipework
- applicable legislative requirements, standards, codes and licensing requirements for installing system components, interconnecting wiring and connection to power supply
- applicable procedures for storage, handling and treatment of ozone depleting and synthetic greenhouse gas refrigerant
- sustainable energy practices for the efficient use of materials and for minimising damage/contamination to environment
- hazards and control measures associated with installing split air conditioning systems, including housekeeping
- tools and equipment used for fabricating pipework
- pipe preparation and joining techniques including cutting, flaring, swaging, bending
- brazing/silver soldering techniques, equipment and consumables
- dry nitrogen is used during all brazing/silver soldering work
- procedures and equipment for checking pipework integrity and compliance to specification
- procedures for reporting non-conformances
- required documentation and procedures to complete and process

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to fabricate pipework for split air conditioning systems and install units and components to manufacturer specifications and relevant Australian Standards, codes and regulations.

Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge; and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing split air conditioning systems or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Split air conditioning systems</b>	Single head split systems up to 18kW cooling capacity
<b>Unit components</b>	Outdoor unit, indoor unit, fittings and fixtures
<b>Site considerations</b>	Inside wall, drains, pipe runs, exposure, access, air circulation, environment, power supply
<b>Prepared</b>	Clearing and levelling, foundations, wall fixtures, roof mounting
<b>Prepared and joined</b>	Cutting to length, flaring, swaging, bending
<b>Pipe joining methods</b>	Silver brazing/soldering
<b>Equipment and testing devices</b>	Refrigeration gauge manifold, Schraeder access valves; quick connect couplings, thermometer/thermocouple temperature measuring devices; analogue and digital vacuum measuring gauges; digital scales; refrigerant recovery unit; vacuum pump; electronic leak detectors, refrigerant containers/cylinders
<b>Industry best practice</b>	Pipe preparation and joining techniques and industry best practice for pipe brazing.
<b>Commonwealth, State and Territory legislation, regulations, standards and codes</b>	The Ozone Protection and Synthetic Greenhouse Gas Legislation Amendment Bill 2003; air conditioning residential best practice guidelines

RANGE STATEMENT	
of practice, industry guidelines	(AIRAH); State and local building regulations; Codes of Practice for domestic refrigeration and air-conditioning. (HB40)
Appropriate testing methods	Dimensional checks, leak tests

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Installation and commissioning
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## MEM11001C Erect/dismantle scaffolding and equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers erecting and dismantling scaffolding and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to erecting scaffolding for maintenance and installation in a workshop and in factories, manufacturing plants and warehouses. It includes preparation, erection and dismantling of the scaffolding/equipment.</p> <p>An awareness of licensing and permit requirements is required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare to erect scaffold/equipment	<p>1.1.Site plans, scaffolding/equipment designs and drawings to industry practices are interpreted as necessary.</p> <p>1.2.Work area is inspected to identify hazards and appropriate prevention/control measures are implemented to avoid hazard.</p> <p>1.3.All work is undertaken safely and to prescribed procedures.</p>
2. Erect scaffold/equipment	<p>2.1.Erection site is prepared to meet job requirements.</p> <p>2.2.Necessary signage and barriers and third party protection measures are placed in appropriate position.</p> <p>2.3.Appropriate scaffolding/equipment components are selected and inspected and damaged components are labelled and rejected.</p> <p>2.4.Rejected components are repaired or sent for repair.</p> <p>2.5.Scaffolding/equipment is erected to plan and in accordance with safe work practices, Australian standards, State and Territory legislative requirements and equipment manufacturers' requirements.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.6.The completed scaffolding/equipment is checked for safety and operational requirements.</p> <p>2.7.Site is left clear of all surplus components, equipment, tools and debris.</p>
3. Inspect, repair and alter scaffold/equipment	<p>3.1.The scaffolding/equipment is inspected for damage, corrosion and wear.</p> <p>3.2.Any alteration or repair is carried out in accordance with safe work practices and legislative requirements.</p> <p>3.3.Any inspection log is completed as required.</p>
4. Dismantle scaffold/equipment	<p>4.1.Work is undertaken safely and to prescribed procedure.</p> <p>4.2.Scaffolding/equipment is inspected for damage, corrosion or wear and is noted for consideration in planning for dismantling.</p> <p>4.3.Scaffolding/equipment is dismantled in accordance with site procedures, State and Territory legislative requirements and critical structural and safety requirements.</p> <p>4.4.Site is cleaned and cleared of all tools, excess material and debris and left in a safe state.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions, specifications and standard procedures. May include drawings for erecting scaffolding
- undertaking basic levelling and alignment
- interpreting instructions and legislative requirements
- using relevant hand tools and manual handling techniques
- assessing risk
- following oral instructions

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• working safely and confidently at heights</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• erection and dismantling procedures as set out in relevant Australian standards</li> <li>• codes of practice, for example the Scaffolder's Guide, relevant acts and regulations</li> <li>• site specific requirements</li> <li>• safety procedures, safe work practices and procedures</li> <li>• use and application of personal protective equipment</li> <li>• hazards and control measures associated with erecting/dismantling scaffolding and equipment, including housekeeping</li> <li>• scaffolding techniques and equipment</li> <li>• limitations of equipment</li> <li>• materials handling, storage and environmentally friendly waste management</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to erect and dismantle scaffolding/equipment safely subject to legislative requirements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic</p>

**EVIDENCE GUIDE**

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with erection and dismantling of scaffolding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, codes, specifications, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Scaffolding/equipment**

- Prefabricated tower scaffolds, fall protection devices, catch platforms and bracket scaffolds (tank and formwork), mobile scaffolds, gin wheels, cantilevered hoist with a load limit not exceeding 500 kilograms (material only),

<b>RANGE STATEMENT</b>	
	<p>safety nets and static lines</p> <ul style="list-style-type: none"> <li>• The major difference between basic and complex scaffolding is the height of the working platform and certain types of scaffolding and configurations</li> </ul>
<b>Hazards</b>	<ul style="list-style-type: none"> <li>• Chemicals, dangerous or hazardous substances/materials</li> <li>• Movement of equipment, goods, materials, vehicular traffic</li> <li>• Uneven/unstable terrain, overhead service lines, trees, underground services, obstructions, structures, surrounding buildings, facilities, bridges/walkways, lifting equipment</li> </ul>
<b>Prescribed procedures</b>	<ul style="list-style-type: none"> <li>• Clarification of instructions and/or plans either written or from authorised personnel</li> <li>• Site safety policy and procedures</li> <li>• Standard operating procedures</li> <li>• Correct use of equipment</li> <li>• Industry standards and requirements</li> <li>• Manufacturers' specifications</li> </ul>
<b>Signage and barriers and third party protection measures</b>	<ul style="list-style-type: none"> <li>• Physical barriers (parawebbing, bollards, timber or metal barriers)</li> <li>• Warning/direction signs</li> <li>• Personnel to restrict unauthorised access (spotters)</li> <li>• Permits to work</li> </ul>
<b>Safe work practices</b>	Hazard identification, risk assessment, risk reduction measures, house keeping and personal protective equipment
<b>State and Territory legislative requirements</b>	<ul style="list-style-type: none"> <li>• Appropriate OHS and Scaffolding acts and regulations</li> <li>• Australian standards, codes of practice and NOHSC:1006</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Materials handling
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## MEM11002C Erect/dismantle complex scaffolding and equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers erecting, maintaining, inspecting/altering/repairing and dismantling complex scaffolding/equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to erecting complex scaffolding to be used generally in maintenance and installation in a workshop, and in factories, manufacturing plants and warehouses. It includes preparation, erection, maintenance, inspection/repair/alteration and dismantling of the scaffolding/equipment.</p> <p>An awareness of licensing and permit requirements is required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM11001C	Erect/dismantle scaffolding and equipment

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare to erect scaffold/equipment	<p>1.1.Site plans, scaffolding/equipment designs and drawings to industry practices are interpreted as necessary.</p> <p>1.2.Work area is inspected to identify hazards and appropriate prevention/control measures are implemented to avoid hazard.</p> <p>1.3.All work is undertaken safely and to prescribed procedures.</p>
2. Erect scaffold/equipment	<p>2.1.Erection site is prepared to meet job requirements.</p> <p>2.2.Necessary signage and barriers and third party protection measures are placed in appropriate position.</p> <p>2.3.Appropriate scaffolding/equipment components are selected and inspected and damaged components are labelled and rejected.</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>2.4.Rejected components are repaired or sent for repair.</p> <p>2.5.Scaffolding/equipment is erected to plan and in accordance with acceptable safe work practices, Australian standards, State or Territory legislative requirements and equipment manufacturers' requirements.</p> <p>2.6.Scaffolding/equipment is checked for safety and operational requirements and faults are identified in accordance with legislative requirements.</p>
3. Inspect, alter and/or repair scaffold/equipment	<p>3.1.Alterations/repairs are confirmed in accordance with safety work practices, Australian standards and equipment manufacturers' requirements.</p> <p>3.2.Alterations/repairs are inspected for safety and operational requirements.</p> <p>3.3.Scope of alteration/repair is confirmed and understood.</p> <p>3.4.Existing scaffold/equipment is inspected for suitability of alterations/repair requirements.</p> <p>3.5.Materials, equipment and tools required for alteration are determined.</p> <p>3.6.Work completion is recorded/reported to appropriate authority.</p>
4. Dismantle scaffold/equipment	<p>4.1.Work is undertaken safely and to prescribed procedure.</p> <p>4.2.Scaffolding/equipment is inspected for damage, corrosion or wear and is noted for consideration in planning for dismantling.</p> <p>4.3.Scaffolding/equipment is dismantled in accordance with site procedures, State and Territory legislative requirements and critical structural and safety requirements.</p> <p>4.4.Site is cleaned and cleared of all tools, excess material and debris and left in a safe state.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- levelling and aligning scaffolding
- interpreting instructions and legislative requirements
- using basic hand tools
- assessing risk in relation to complex scaffolding erection
- using manual handling techniques
- undertaking site clean up and remediation
- working safely and confidently at heights

### Required knowledge

Look for evidence that confirms knowledge of:

- erection and dismantling procedures as set in relevant Australian standards
- codes of practice, for example the Scaffolder's Guide, relevant acts and regulations
- site specific requirements
- safety procedures, safe work practices and procedures
- sequence of operations in erecting the scaffolding
- types of scaffolding systems
- hazards and control measures; electrical, stability, mobile plant issues/requirements; falls protection measures; minimum gap requirements; safe access and egress
- deck loadings
- use and application of personal protective equipment
- scaffolding techniques and equipment
- limitations of equipment
- materials handling, storage and environmentally friendly waste management

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to erect, maintain and dismantle complex

<b>EVIDENCE GUIDE</b>	
	scaffolding/equipment safely and subject to legislative requirements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with erection, maintenance and dismantling of complex scaffolding or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Scaffolding/equipment

- Prefabricated tower scaffolds, tube and fitting scaffolds as limited by legislative requirements, tube and coupler scaffolds including tube and coupler covered ways and gantries, fall protection devices, catch platforms, bracket scaffolds (tank and formwork), mobile scaffolds, ropes, cantilevered hoists, cantilevered and spurred scaffolds, cantilever crane loading platforms and course-ways, fall protection devices, platforms
- Complex scaffolding means Intermediate Scaffolding and above as set out in the legislative requirements in each State and Territory. The major difference between complex and basic scaffolding is the height of the working platform and certain types of scaffolding and configurations
- Maintaining scaffolding means ensuring that the scaffolding remains in a safe condition according to manufacturers' specifications and legislative requirements

#### Hazards

- Chemicals, dangerous or hazardous substances/materials
- Movement of equipment, goods, materials, vehicular traffic
- Uneven/unstable terrain, overhead service lines, trees, underground services, obstructions, structures, surrounding buildings, facilities, bridges/walkways, lifting equipment

#### Prescribed procedures may include

- Clarification of instructions either written or from authorised personnel
- Site safety policy and procedures
- Standard operating procedures
- Correct use of equipment

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Industry standards and requirements</li> <li>• Manufacturers' specifications</li> </ul>
<b>Signage, barriers and third party protection measures may include</b>	<ul style="list-style-type: none"> <li>• Physical barriers (parawebbing, bollards, timber or metal)</li> <li>• Warning/direction signs</li> <li>• Personnel to restrict unauthorised access (spotters)</li> <li>• Permits to work</li> </ul>
<b>Safe work practices may include</b>	Hazard identification, risk assessment, standard operating procedures, house keeping and personal protective equipment.
<b>State or Territory legislative requirements</b>	<ul style="list-style-type: none"> <li>• Appropriate OH&amp;S and Scaffolding acts and regulations.</li> <li>• Australian standards and codes of practice and</li> <li>• NOHSC:1006</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Materials handling
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## MEM11003B Coordinate erection/dismantling of complex scaffolding/equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers coordinating the erection, alteration, repair and dismantling of scaffolding/equipment, and inspecting the completed scaffold/equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals coordinating a scaffolding team or employed in a supervisory capacity for the erection, maintenance and dismantling of scaffolding and equipment in a workshop, and in factories, manufacturing plants and warehouses.</p> <p>If specific skills are required for the repair of the scaffolding, personnel with appropriate competencies are accessed.</p> <p>Licensing and permit requirements are addressed accordingly.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

Prerequisite units		
Path 1	MEM11001C	Erect/dismantle scaffolding and equipment
	MEM11002C	Erect/dismantle complex scaffolding and equipment
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan and coordinate erection of scaffold/equipment	<p>1.1.Site plans, scaffolding/equipment designs and drawings to industry practices are interpreted as necessary.</p> <p>1.2.Work area is inspected to identify hazards and appropriate prevention/control measures are implemented to avoid hazard.</p> <p>1.3.All work is undertaken safely and to prescribed procedures.</p> <p>1.4.Erection site is prepared to meet job and safety</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>requirements.</p> <p>1.5.Necessary signage and barriers are placed in appropriate position.</p> <p>1.6.Scaffolding/equipment erection is coordinated in accordance with acceptable safe work practices, Australian standards, State or Territory legislative requirements and equipment manufacturers' requirements.</p> <p>1.7.Completed scaffolding/equipment is inspected for safety and compliance with design, operational and statutory requirements.</p>
2. Coordinate alterations and repairs of scaffold/equipment	<p>2.1.Scope of alteration/repair is confirmed and understood.</p> <p>2.2.Existing scaffolding/equipment is inspected and alterations/repairs determined.</p> <p>2.3.Materials, equipment and tools required for alterations are determined.</p> <p>2.4.Existing or new load requirements are determined using load tables.</p> <p>2.5.Alteration/repairs are coordinated in accordance with safety work practices, Australian standards and equipment manufacturers' requirements.</p> <p>2.6.Alterations/repairs are inspected for safety and operational requirements.</p> <p>2.7.Work completion is reported to appropriate personnel and recorded.</p>
3. Inspect completed scaffold/equipment	<p>3.1.The critical structural and safety areas of the scaffolding/equipment are inspected for damage, corrosion and wear.</p> <p>3.2.Scaffolding/equipment and structure is checked against the type of scaffolding/equipment and structure specified in the plan.</p> <p>3.3.Inspection log is completed.</p> <p>3.4.Potential safety and design/structural hazards are reported for rectification.</p>
4. Coordinate dismantling of scaffold/equipment	<p>4.1.Work is coordinated safely and to standard operating procedure.</p> <p>4.2.Scaffolding/equipment is removed from site in accordance with standard operating procedures and critical structural and safety requirements.</p> <p>4.3.Site clearance is coordinated, and surplus material, equipment, tools and debris are removed and site left</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>in safe and operational state.</p> <p>4.4. Work completion is reported to appropriate authority.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- levelling and alignment of scaffolding
- interpreting instructions and legislative requirements
- using basic hand tools
- assessing risk
- using manual handling techniques
- cleaning up and site remediation
- time management
- determining personnel and equipment requirements
- inspecting completed scaffolding with reference to structural integrity and design faults
- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- planning, sequencing operations
- checking and clarifying strategies
- working safely and confidently at heights

#### Required knowledge

Look for evidence that confirms knowledge of:

- erection and dismantling procedures as set in the Australian standards
- codes of practice, for example the Scaffolder's Guide
- site specific requirements
- safety procedures
- types of scaffolding systems
- deck loadings
- hazards; electrical, stability, mobile plant issues/requirements; falls protection measures; minimum gap requirements; safe access and egress

**REQUIRED SKILLS AND KNOWLEDGE**

- sequence of operations in erecting and dismantling the scaffolding
- design and materials faults such as rust, wear and tear, stress
- use and application of personal protective equipment
- safe work practices and procedures
- scaffolding techniques and equipment
- limitations of equipment
- materials handling, storage and environmentally friendly waste management

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to coordinate the erection, repair, maintenance and dismantling of all scaffolding applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with coordination of the erection, repair, maintenance

<b>EVIDENCE GUIDE</b>	
	and dismantling of all scaffolding applications or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Scaffolding/equipment</b>	<ul style="list-style-type: none"> <li>• Tube and fitting scaffolds as limited by legislative requirements</li> <li>• Fall protection devices</li> <li>• Catch platforms</li> <li>• Standing prefabricated tower scaffolds and bracket scaffolds</li> <li>• Mobile scaffolds</li> <li>• Cantilevered hoists</li> <li>• Cantilevered and spurred scaffolds</li> <li>• Platforms and course-ways</li> <li>• Suspended scaffolds</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Cantilevered cranes</li> <li>• Loading platforms</li> <li>• Hung scaffolds</li> </ul> <p>Complex scaffolding means Intermediate Scaffolding and above as set out the legislative requirements in each State and Territory. The major difference between the complex and basic scaffolding is the height of the working platform and certain types of scaffolding and configurations</p>
<b>Hazards</b>	<ul style="list-style-type: none"> <li>• Chemicals, dangerous or hazardous substances/materials</li> <li>• Movement of equipment, goods, materials, vehicular traffic</li> <li>• Uneven/unstable terrain, overhead service lines, trees, underground services, obstructions, structures, surrounding buildings, facilities, bridges/walk ways, lifting equipment</li> </ul>
<b>Prescribed procedures</b>	<ul style="list-style-type: none"> <li>• Clarification of instructions either written or from authorised personnel</li> <li>• Site safety policy and procedures</li> <li>• Standard operating procedures</li> <li>• Correct use of equipment</li> <li>• Industry standards and requirements</li> <li>• Manufacturers' specifications</li> </ul>
<b>Signage and barriers</b>	<ul style="list-style-type: none"> <li>• Physical barriers (parawebbing, bollards, timber or metal barriers)</li> <li>• Warning/direction signs</li> <li>• Personnel to restrict unauthorised access (spotters)</li> <li>• Permit signage</li> </ul>
<b>Safe work practices</b>	Hazard identification, control measures, risk assessment, standard operating procedures, house keeping and personal protective equipment
<b>State or Territory legislative requirements</b>	<ul style="list-style-type: none"> <li>• Appropriate OH&amp;S and Scaffolding acts and regulations</li> <li>• Australian standards and codes of practice and</li> <li>• NOHSC:1006</li> </ul>

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Materials handling
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## MEM11004B Undertake dogging

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers attaching slings to loads and moving loads using appropriate communication and signalling methods.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the skills used when working with loads, selecting equipment and communicating with a crane driver in a workshop or on site.</p> <p>The scope of work is to demonstrate competence in the application of slinging techniques, selection and inspection of lifting gear, and direction of the crane/hoist operator in the movement of the load including when the load is out of view of the operator.</p> <p>This unit is not intended to apply to machine loading and simple straight lifts where knowledge of codes and signals is not required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Attach lifting gear to loads	<p>1.1.Potential hazards associated with the use of cranes and other load shifting equipment are identified and measures to eliminate or control these hazards are planned.</p> <p>1.2.Site information is obtained as necessary.</p> <p>1.3.All work is undertaken safely and to prescribed procedures.</p> <p>1.4.Load is inspected and best lifting method determined.</p> <p>1.5.Load shifting equipment is selected appropriate to load.</p> <p>1.6.Lifting gear is inspected and damaged or worn items are labelled and rejected.</p> <p>1.7.Where appropriate, safe working loads are calculated</p>



ELEMENT	PERFORMANCE CRITERIA
	to Australian standards. 1.8.Lifting gear is attached to load in most appropriate and safe manner and to specifications where required.
2. Move loads	2.1.Load moving is performed to acceptable safe working practices, Australian standards, codes of practice and specifications. 2.2.Lifting gear is connected to load shifting equipment using safe and appropriate techniques. 2.3.Communication and signalling methods are used as appropriate to coordinate the load movement in a safe manner. 2.4.Load is grounded or put down in accordance with prescribed procedure, in a safe and stable manner. 2.5.All lifting gear is detached from load mover and load.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting lifting methods and load shifting equipment appropriate to the task
- attaching loads
- calculating safe working loads
- communicating with related personnel about the lift
- using of basic hand tools relating to lifts
- identifying hazards and assessing risk
- identifying damaged/worn lifting gear
- self management
- team work
- problem solving

#### Required knowledge

Look for evidence that confirms knowledge of:

## REQUIRED SKILLS AND KNOWLEDGE

- Australian standards, codes of practice and specifications
- lifting methods and lifting gear to suit various loads
- dogging signals and communication methods
- calculations relevant to lifting procedures
- lifting methods
- types and applications of load shifting equipment
- hazards and control measures associated with dogging
- use and application of personal protective equipment
- safe work practices and procedures
- licensing requirements
- permit requirements
- site/non-site personnel
- manufacturers' specifications
- enterprise procedures
- workplace communication procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to calculate, sling, and arrange safe movement of a load. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

**EVIDENCE GUIDE**

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the calculation and safe movement of loads or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Hazards**

May include overhead power lines, trees, overhead service lines (such as steam, gas, water, telephone), underground services, uneven and/or unstable ground, allowable floor loading as

<b>RANGE STATEMENT</b>	
	appropriate, other workers and persons, surrounding buildings/vessels/structures equipment, hazardous materials, corrosive substances, barricades, inadequate lighting and radio interference
<b>Load shifting equipment</b>	May include overhead cranes, overhead gantry, forklift with approved lifting boom/jib, mobile cranes
<b>Lifting method</b>	Slings in an appropriate configuration
<b>Lifting gear</b>	Tags, slings, ropes, shackles, lifting clutches, snatch blocks, I bolts, spreader beams, chain blocks, chain shorteners and may include equalising sheaves, collared I bolts, turn buckles, rigging screws and lifting lugs
<b>Calculations</b>	Load and gear calculations
<b>Safe working practices</b>	<ul style="list-style-type: none"> <li>• Inspection of the environment</li> <li>• Assessment of hazards</li> <li>• Personnel safety</li> </ul>
<b>Communication and signalling methods</b>	<ul style="list-style-type: none"> <li>• Signals are given both within sight and out of sight of equipment operators.</li> <li>• Signals include stop, raise, lower, slew, luff, extend and retract boom, using hands, verbal instructions and whistles</li> </ul>
<b>State or Territory legislative requirements</b>	<ul style="list-style-type: none"> <li>• Appropriate OH&amp;S and acts and regulations</li> <li>• Australian standards and codes of practice and</li> <li>• NOHSC:1006</li> <li>• AS1418</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Materials handling
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## MEM11005B Pick and process order

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers receiving an order, picking an order, checking against documentation, placing in the correct area and completing enterprise documentation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies where the employee needs to exercise knowledge of the enterprise product range and the procedures, practices and standards for the storage and handling of a product.</p> <p>If materials handling equipment skills are needed, Unit MEM11010B (Operate mobile load shifting equipment) should be accessed.</p> <p>Simple handling of goods not requiring the ability to identify different products or to interact with inventory records and stock location systems is covered by Unit MEM11010B (Operate mobile load shifting equipment) or Unit MEM11011B (Undertake manual handling).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Receive order	1.1.Orders are received and checked for errors. 1.2.Product to be picked is identified.
2. Pick order	2.1.Materials handling equipment appropriate to products is selected and used, if required. 2.2.Products to be picked are located using standard operating procedures. 2.3.Order is picked accurately, either by manual handling or using materials handling equipment. 2.4.Product is handled according to storage and handling requirements identified in standard operating procedures/regulations.

ELEMENT	PERFORMANCE CRITERIA
3. Finalise order picking	3.1.Picked order is checked against documentation. 3.2.Picked order is placed in correct area for consolidation. 3.3.Enterprise documentation is completed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on written orders and standard operating procedures. May include simple drawings
- using materials handling equipment in a warehouse
- identifying dangerous goods
- following oral instruction
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- safe manual handling procedures
- reasons for selecting materials handling equipment
- safe storage and handling procedures for a range of products including dangerous goods
- applicable Material Safety Data Sheets
- applicable industry standards, national/Australian standards, NOHSC guidelines, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with picking and processing orders



## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to pick and process orders and store products according to enterprise procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with picking and processing orders or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

#### Guidance information for

**EVIDENCE GUIDE**

assessment

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Materials handling equipment**

Forklift, order picker, WAVE truck, pallet trucks, wheelbarrow, trolleys, sack truck

**Storage and handling requirements**

As per legislative requirements e.g. dangerous goods and storage of poisons acts and regulations

**Enterprise documentation**

Invoices, orders, returns, recording cards, inventory documentation, maintenance inventories, etc. and may include documents (hardcopy or electronic) required by legislation

**Unit Sector(s)**

Unit sector

**Co-requisite units**

Co-requisite units

## Competency field

Competency field	Materials handling
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## MEM11006B Perform production packaging

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers packaging and labelling of finished goods for storage or transport.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit typically applies in a production/process environment. It would normally involve packing of finished goods, including assemblies, sub-assemblies, individual or multiple components. This unit is not intended to apply in situations where simple interim packing, storage and/or stacking are undertaken in context of a production function.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake packaging	1.1.Packaging requirements are identified from instructions or determined by safety, storage conditions, site and legislative requirements. 1.2.Packaging is undertaken to standard operating procedures.
2. Label packaged items	2.1.Identification labels, tags and stickers are checked for correctness and appropriately placed/attached. 2.2.Packaged items are stored in a safe, orderly and retrievable manner and the location in the warehouse/store is recorded.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- reading and interpreting routine information on written job instructions and standard operating procedures. May include simple drawings
- determining packaging requirements from safety, storage conditions, site and legislative requirements
- labelling packaged items
- handling and storing products
- using scanning devices, if required
- following oral instruction
- entering routine and familiar information on to proforma and standard workplace forms
- orally reporting routine information

### Required knowledge

Look for evidence that confirms knowledge of:

- labelling procedures and standards
- storage and recording procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with production packaging

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to undertake production packaging and labelling of items.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with production packaging or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Packaging requirements</b>	<ul style="list-style-type: none"> <li>• Packaging methods include manual processes, semi automatic and fully automated packaging equipment</li> <li>• Procedures undertaken include standards, codes, legislative, company and customer requirements</li> <li>• Packaging material is generally determined from instructions, written or verbal</li> </ul>
<b>Storage conditions, site and legislative requirements</b>	As per legislative requirements e.g. dangerous goods and storage of poisons acts and regulations

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Materials handling
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## MEM11007B Administer inventory procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using inventory procedures and requisitioning goods.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the administration of inventory procedures using manual or electric systems to support or maintain stores or inventory systems, for example Just-in-Time or KANBAN systems.</p> <p>Where routine activity within standard operating procedure is undertaken, refer to Unit MEM16006A (Organise and communicate information) or Unit MEM16008A (Interact with computing technology).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Use inventory procedures	<ul style="list-style-type: none"><li>1.1.Inventory procedures are applied to standard operational procedures.</li><li>1.2.Requisition, purchase, shipping and invoice documentation is used as required to standard operational procedures.</li><li>1.3.Inward/outward recording/filing system is accessed and maintained to standard operational procedures.</li><li>1.4.Customer orders are maintained to standard operational procedures.</li><li>1.5.Returned orders are booked back using standard operational procedures.</li></ul>
2. Requisition goods	<ul style="list-style-type: none"><li>2.1.Requisition procedures are applied to standard operational procedures.</li><li>2.2.Goods are requisitioned on time.</li><li>2.3.All recording is completed and filed correctly in accordance with site procedures.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on requisition, purchase, shipping and invoice documentation, standard operating procedures, charts, lists and other applicable reference documents
- accessing and maintaining manual and electronic inventory information
- undertaking numerical operations and calculations within the scope of this unit
- organising information
- recording and filing information
- managing time
- checking for conformance to specifications
- measuring to specified tolerances
- entering information on to manual and electronic proformas and standard workplace documents

#### Required knowledge

Look for evidence that confirms knowledge of:

- features and application of inventory systems such as Just-in-Time, KANBAN
- inventory procedures
- safe work practices and procedures
- use and application of personal protective equipment
- hazards and control measures associated with administering inventory procedures
- measurement techniques, tools and equipment for administering inventory procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to administer inventory procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with inventory procedures or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Inventory procedures**

Inventory systems such as Just-in-Time or KANBAN systems

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

**Competency field****Competency field**

Materials handling

## MEM11008B Package materials (stores and warehouse)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining packaging requirements, packaging and labelling items in a stores and warehousing environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to determining appropriate packaging and includes stacking, storage, weight, size, material type and expected life and transport requirements. Packaging includes sequenced packaging and point of pick up packaging, packaging materials and methods.</p> <p>Competencies covered by this unit are typically performed in a store or warehouse and often relate to receive or dispatch functions.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine packaging requirements	1.1.Safety or special packaging requirements are determined. 1.2.Storage requirements to meet safety, storage conditions, site and legislative requirements are determined. 1.3.Transport and store requirements are determined.
2. Undertake packaging	2.1.The most appropriate packaging method to suit the product is selected and used. 2.2.Correct seal, compression and packaging materials are used.
3. Label packaged items	3.1.Labels and identification stickers are correctly applied and accurately describe content of package.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting packaging methods and materials to suit given products
- effectively communicating with the production and dispatch personnel
- undertaking numerical operations and calculations within the scope of this unit
- managing time
- following procedures for labelling packaged products
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- packaging methods, materials and legislation
- weights, measures and capacities
- types of transport
- knowledge of organisational receipt and dispatch functions
- applicable material safety data sheets (MSDS)
- labelling procedures and standards
- storage and recording procedures
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with packaging materials

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to package goods in a store/warehouse environment.



<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with packaging goods in a store or warehouse or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Storage requirements</b>	As per legislative requirements e.g. dangerous goods and storage of poisons acts and regulations
<b>Site and legislative requirements</b>	<ul style="list-style-type: none"> <li>• Site requirements: standard operating procedures, organisational policy</li> <li>• Legislative requirements e.g. dangerous goods, storage of poisons, environmental protection acts and regulations</li> </ul>
<b>Transport and store requirements</b>	<ul style="list-style-type: none"> <li>• Racks, boxes, bins, etc.</li> <li>• Road, rail, courier transport</li> <li>• Dangerous goods code for transport of goods</li> </ul>
<b>Packaging methods and materials</b>	<ul style="list-style-type: none"> <li>• Wrapping, shrink wrapping, wrapping in bubble wrap, polystyrene packing, pallets, crates/boxes and other methods</li> <li>• Sealing, such as packing tape, banding, boxes, pallet racking</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

## Competency field

Competency field	Materials handling
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## MEM11009B Handle/move bulk fluids/gases

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining appropriate handling methods and storing bulk fluids and gases.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to activities in a range of environments that involve handling commercial quantities of fluids and gases greater than the quantities required by individuals to do their own jobs.</p> <p>Emergency procedures are predetermined by appropriately qualified and authorised personnel.</p> <p>Material properties are determined from instructions, charts, manufacturers' specifications and information sheets.</p> <p>The unit applies to all containers used to store bulk fluids/gases.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine handling methods	1.1.Type of material is determined from labels, colour codes, signage. 1.2.Material properties are understood. 1.3.All relevant material properties are identified or clarified with appropriately qualified and authorised authority. 1.4.All relevant safety and emergency procedures are understood and implemented as required. 1.5.All relevant legislation, regulations and codes of practice are understood and observed. 1.6.Correct and appropriate handling methods are undertaken.
2. Store bulk	2.1.Correct storage conditions are determined from

ELEMENT	PERFORMANCE CRITERIA
fluids/gases	<p>instructions/manufacturers' specifications/directions.</p> <p>2.2.Containers are checked for safe and clean use.</p> <p>2.3.Containers are filled/emptied in accordance with standard operating procedures, regulations/legislative requirements.</p> <p>2.4.Containers are handled and moved in accordance with site procedures, regulations/legislative requirements.</p> <p>2.5.Containers are correctly labelled and stored to standard operational procedures, regulations/legislative requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following handling and storage instructions, labels, colour codes, signage and terminology
- calculating quantities
- communicating with users of the materials and appropriately qualified and authorised authority
- orally reporting routine information
- checking and clarifying task-related information
- applying appropriate Materials Safety Data Sheet
- selecting personal protective clothing and equipment
- filling/emptying applicable containers
- storing and handling bulk fluids/gases
- entering routine and familiar information onto labels, proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- OH&S and dangerous goods acts and regulations, transport of dangerous goods code, and industry codes of practice and standards relevant legislative requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- organisation's emergency response plan
- procedures for filling and emptying storage containers
- packaging requirements for dangerous goods
- personal protective clothing and equipment for various substances
- cleaning requirements for storage containers
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to handle and store bulk fluids and gases.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with handling and storage bulk fluids and gases or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid,

**EVIDENCE GUIDE**

	sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Material properties</b>	<ul style="list-style-type: none"> <li>Gas, solid, liquid</li> <li>Material properties are determined from material safety data sheet, dangerous goods code, manifest or register</li> </ul>
<b>Safety and emergency procedures</b>	Emergency procedures are determined by organisational emergency response plan, and advice may be sought from appropriately qualified and/or authorised personnel
<b>Legislation, regulations and codes of practice</b>	Relevant jurisdictions OH&S and dangerous goods acts and regulations, transport of dangerous goods code, and industry codes of practice and standards
<b>Storage conditions</b>	Separation and segregation to legislative requirement and dangerous goods code



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11010B Operate mobile load shifting equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating mobile load shifting equipment, including moving and placing loads.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the general operation of mobile load shifting equipment, including planning the work, moving and placing loads, and shutting down and securing equipment after operation where knowledge of codes and signals is not required. The unit applies to moving loads in workshops and/or on site.</p> <p>This may include but is not limited to factories, wharfs, ships, warehouses, manufacturing plants, building sites, road construction, demolition sites, quarries and mine sites.</p> <p>If hand tools are required, Unit MEM08001B (Use hand tools) should also be selected.</p> <p>Awareness of licensing requirements - licenses may be required for mobile load shifting equipment in some jurisdictions.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare to shift loads	<p>1.1. Work area is inspected to identify hazards, and appropriate prevention/control measures are implemented to avoid hazards.</p> <p>1.2. Routine pre-operational checks are undertaken in accordance with manufacturers' specifications and regulatory safety requirements.</p> <p>1.3. Attachments and/or equipment are inspected.</p>
2. Check controls and equipment	<p>2.1. Pre-operational and post start-up equipment checks are carried out in accordance with manufacturers' specifications and/or operating manual.</p> <p>2.2. Defects and damage are reported according to site procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Shift loads	<p>3.1.The most appropriate load shifting device is selected to suit load and shifting requirements.</p> <p>3.2.Load shifting device is operated within design specifications and safe working load in accordance with standard operating procedures.</p> <p>3.3.Load is lifted, ensuring balance, vision of operation and protection of load.</p> <p>3.4.The safe and efficient path of movement is selected and used.</p> <p>3.5.Path of movement is checked and monitored for obstacles and hazards and safely are maintained.</p>
4. Place loads	<p>4.1.Loads are placed ensuring safety, stability, protection of material and avoidance of hazards on site.</p>
5. Shut down equipment and secure site	<p>5.1.Machinery is parked avoiding equipment hazards.</p> <p>5.2.Shut-down is conducted in accordance with manufacturers' specification to isolate vehicles.</p> <p>5.3.Post-operational check is completed in accordance with operational procedures.</p> <p>5.4.Machinery is parked in accordance with standard operating procedures, avoiding site hazards.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting and following routine information on standard operating procedures. May include simple drawings, tables and figures, written documents
- performing routine safety, basic service and maintenance procedures
- calculating load masses and safe working loads
- selecting appropriate load shifting device
- following oral instructions
- safely operating load shifting devices and shifting loads
- working with others
- interpreting communication signals and instructions

**REQUIRED SKILLS AND KNOWLEDGE**

- determining load masses and equipment requirements
- determining mass of irregular shaped loads
- demonstrating emergency operating procedures
- communicating faults, malfunctions and workplace hazards, reports and maintenance of operational records

**Required knowledge**

Look for evidence that confirms knowledge of:

- pre-operational checks
- design specifications of load shifting device
- load chart
- licensing requirements
- load protection
- safe load placement
- operational environment
- appropriate permits
- hazards and control measures associated with load shifting and equipment
- use and application of personal protective equipment
- safe work practices and procedures
- workplace communication procedures
- manufacturers' specifications

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to operate load sifting equipment to move and place loads.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using load sifting equipment to move and place loads or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Pre-operational checks</b>	Battery, water, fuel, hazards warning lights, fluid or gas leaks, braking, movement of booms, visual checks of tyres, emergency devise/alarms, log books, operating motions, evidence of damage, excessive wear and tear, as determined by manufacturers' specifications and standard operating procedures
<b>Attachments and/or equipment</b>	Hooks, electromagnetic hook, buckets, slings, tag lines, buckets, trench, excavating, rock breakers, shackles, lifting lugs, fork arms
<b>Post start-up</b>	<ul style="list-style-type: none"> <li>• Hazards warning systems, attachments, movements and control functions are smooth</li> <li>• Operating and emergency controls and safety devices are located, identified and tested</li> <li>• Communication signals are confirmed</li> <li>• Defects and damage are reported</li> </ul>
<b>Load shifting device</b>	Front end loaders/back hoes, ride on forklifts and pallet trucks, bobcats, vehicle loading crane
<b>Safe working load</b>	Weight of load is assessed to ensure compliance with equipment load plate specifications
<b>Standard operating procedures</b>	Industry standards, production schedules, material safety data sheets, work notes and plans, product labels, manufacturers' specifications, operator manuals, enterprise policies and procedures, supervisors' oral and written instructions, current State/Territory occupational health and safety legislation, standards and codes of practice
<b>Obstacles and hazards</b>	<ul style="list-style-type: none"> <li>• Overhead cables, personnel, obstacles (fixed and moveable), trenches, pits, uneven terrain, trees, underground services</li> <li>• Exposure to chemicals, dangerous or hazardous substances</li> <li>• Movements of equipment, goods, materials and vehicular traffic</li> </ul>
<b>Shut-down</b>	<ul style="list-style-type: none"> <li>• Post-operational equipment checks, motion locks and brakes are applied</li> <li>• Lifting equipment is checked</li> <li>• Defective equipment is identified, segregated</li> </ul>

**RANGE STATEMENT**

	and reported to supervisor • Equipment is correctly stowed
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11011B Undertake manual handling

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers lifting and moving materials manually.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to lifting and moving materials manually and/or using basic manual handling equipment in a wide range of environments.</p> <p>Maximum manual lifting weight is limited to National Occupational Health and Safety Commission (NOHSC) recommendations.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Lift materials manually	<p>1.1. Material weight is determined correctly utilising most appropriate technique, and risks associated with lifting are assessed.</p> <p>1.2. Lifting techniques are undertaken to National Occupational Health and Safety Commission (NOHSC) and standard operating procedures. Types of movement, methods, storage, height and position are considered.</p>
2. Move/shift materials manually	<p>2.1. Appropriate equipment is selected where required.</p> <p>2.2. Material is placed safely and securely on moving equipment.</p> <p>2.3. Material is relocated ensuring safety of personnel and security of material.</p> <p>2.4. Material is unloaded from moving equipment and placed in a safe and secure manner.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- identifying relevant standards and lifting techniques
- assessing weight of material
- selecting lifting equipment
- working and communicating in teams
- assessing risks
- planning
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions

### Required knowledge

Look for evidence that confirms knowledge of:

- manual handling techniques
- hazards of incorrect procedures
- NOHSC standards for manual handling
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to move loads manually using appropriate aids.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with moving loads manually or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Material weight</b>	Material weight is determined using scales or interpreting signage
<b>Lifting techniques</b>	Individual or team lifting, use of appropriate lifting equipment
<b>Appropriate equipment</b>	Hand trolleys, wheelbarrows, motorised/hand pallet trucks (not sit on), scissor lifts, boom lifts, hand carts, dedicated production or process lifting equipment such as baskets, spreader bars, cradles or the like attached to lifting equipment

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Materials handling
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## MEM11012B Purchase materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining purchasing requirements, preparing purchase order/list and purchasing materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to purchasing one-off or multiple quantities of raw materials, components, equipment etc. Contracts and paperwork may be generated manually or electronically using the on-site system.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine purchasing requirements	<p>1.1. Client, customer, user is consulted as necessary to determine purchasing requirements.</p> <p>1.2. Material specifications are determined from orders, instructions and/or technical drawings.</p> <p>1.3. Quantities, price limitations and delivery requirements are determined from orders, instructions.</p>
2. Prepare purchase order/list	2.1. Purchase order/list is developed to standard operational procedure.
3. Purchase material	<p>3.1. Standard operating procedures are followed.</p> <p>3.2. Supplier/vendor is informed of requirements and specifications.</p> <p>3.3. Purchasing schedules are adjusted where required to standard operating procedures.</p> <p>3.4. Appropriate paperwork/contracts are exchanged to standard operating procedures.</p> <p>3.5. Records/files are maintained accurately using standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on orders, instructions and/or technical drawings, standard operating procedures, purchasing schedules, orders, records, files and other applicable reference documents
- planning and sequencing tasks
- checking and clarifying information
- entering and maintaining information on manual and electronic workplace documents
- checking for conformance to specifications
- communicating with client, customer, user, supplier/vendor
- identifying purchasing specifications
- calculating quantity, price and delivery requirements
- selecting suppliers
- maintaining purchase documentation

#### Required knowledge

Look for evidence that confirms knowledge of:

- suppliers and available products
- purchasing procedures
- contract initiation and exchange procedures
- safe work practices and procedures
- hazards and control measures associated with purchasing materials

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare a purchase order and purchase



<b>EVIDENCE GUIDE</b>	
	materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing a purchase order and purchasing materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Purchasing</b>	Can cover one-off or multiple quantities of raw materials, components, equipment etc.
<b>Purchasing schedules</b>	<ul style="list-style-type: none"> <li>• Purchasing specifications - determined from standard engineering drawings and data sheets, instructions written or verbal</li> <li>• Purchasing schedules - developed to site procedures and for pre-contracted suppliers/vendors</li> </ul>
<b>Paperwork/contracts</b>	Generated manually or electronically utilising on-site system

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Materials handling
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## MEM11013B Undertake warehouse receipt process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking supplier documentation, confirming the quality and quantity of received goods, arranging the unloading of goods and preparing, locating and storing goods.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the receipt of goods in a store or warehousing environment and the application of the knowledge of warehouse systems and procedures.</p> <p>Complementary communication, planning and quality skills are described in the appropriate core units.</p> <p>If load shifting equipment operation skills are required, Unit MEM11010B (Operate mobile load shifting equipment) should be accessed.</p> <p>If hazardous goods are received and handled, Unit MEM13003B (Work safely with industrial chemicals and materials) should also be accessed.</p> <p>If the received goods are bulk fluids or gases (i.e. large commercial quantities), then Unit MEM11009B (Handle/move bulk fluids/gases) may also apply.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM11011B	Undertake manual handling

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check supplier documentation	1.1. Supplier documentation is checked against order according to standard operating procedures.
2. Confirm the quality and quantity of received goods	2.1. The quality and quantity of goods are checked against order and supplier documentation. 2.2. Incorrect and damaged goods are identified and appropriate action is taken to standard operating procedures.
3. Arrange unloading of goods	3.1. Goods requiring special unloading procedures are identified. 3.2. Goods are unloaded using manual handling or

ELEMENT	PERFORMANCE CRITERIA
	<p>appropriate lifting equipment.</p> <p>3.3. Carrier or supplier documentation is signed or processed according to standard operating procedures.</p>
4. Prepare, locate and store received goods	<p>4.1. Goods are prepared for storage according to standard operating procedures.</p> <p>4.2. Signs, codes or labels are applied according to standard operating procedures.</p> <p>4.3. Inventory records documentation is completed.</p> <p>4.4. Storage location is identified.</p> <p>4.5. Goods are stored in correct location using appropriate materials handling techniques.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting information on job instructions, orders, supplier documents, signs, codes, labels and other applicable reference documents
- checking orders, quantities, descriptions and supplier documentation
- maintaining goods inwards documentation
- manual handling within the scope of this unit
- selecting and using appropriate lifting equipment
- operating lifting equipment for goods inwards
- selecting storage procedures and processes, including labelling
- entering information onto manual and electronic workplace documents

#### Required knowledge

Look for evidence that confirms knowledge of:

- relevant legislation, regulations and codes
- checking and recording processes and procedures
- handling of hazardous goods
- storage procedures and processes, including labelling

**REQUIRED SKILLS AND KNOWLEDGE**

- safe work practices and procedures
- hazards and control measures associated with undertaking warehouse receipt processes

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to undertake warehouse receipt processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with warehouse receipt processes or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

<b>EVIDENCE GUIDE</b>	
	observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Documentation</b>	Invoice, carrier or supplier documentation, purchase specifications
<b>Special unloading procedures</b>	Special unloading procedures may be required in respect of hazardous goods, chemicals/poisons and goods where size, shape, fragility require special procedures
<b>Lifting equipment</b>	Hand trolleys, wheelbarrows, motorised/hand pallet trucks (not sit on), hand carts, and dedicated production or process lifting equipment such as baskets, spreader bars, cradles or the like attached to lifting equipment
<b>Codes</b>	Dangerous goods acts and regulations, storage of chemicals/poisons, industry codes of practice, environmental codes etc.



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11014B Undertake warehouse dispatch process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers arranging and consolidating orders, preparing and dispatching goods.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the dispatch of goods in a store or warehousing environment and the application of the knowledge of warehouse systems and procedures.</p> <p>Complementary communication, planning and quality skills are described in appropriate core units.</p> <p>If load shifting equipment operation skills are required, Unit MEM11010B (Operate mobile load shifting equipment) should be accessed.</p> <p>If hazardous goods are dispatched, Unit MEM13003B (Work safely with industrial chemicals and materials) should also be accessed.</p> <p>If the dispatched goods are bulk fluids and gases (i.e. large commercial quantities), then Unit MEM11009B (Handle/move bulk fluids/gases) may also apply.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM11006B	Perform production packaging
	MEM11011B	Undertake manual handling
Path 2	MEM11008B	Package materials (stores and warehouse)
	MEM11011B	Undertake manual handling

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Arrange and consolidate orders	1.1.Packed orders are consolidated into customer or carrier batches according to standard operating procedures. 1.2.Consolidated goods are placed into correct dispatch area.
2. Prepare for dispatch	2.1.Goods are packed, shrink-wrapped and/or palletised.

ELEMENT	PERFORMANCE CRITERIA
of goods	<p>2.2.Goods are labelled and appropriate documentation is attached according to standard operating procedures.</p> <p>2.3.Goods are placed in dispatch area ready for loading according to pick-up schedule and carrier requirements.</p>
3. Dispatch goods	<p>3.1.Carrier and customer documentation is checked.</p> <p>3.2.Loading and transportation requirements are accurately communicated to driver and received from the driver.</p> <p>3.3.Goods are loaded onto vehicle using appropriate materials handling techniques and devices.</p> <p>3.4.Inventory records/documentation is completed according to requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting information on job instructions, orders, supplier documents, signs, codes, labels and other applicable reference documents
- checking orders, quantities, descriptions and supplier documentation
- packing, shrink-wrapping and/or palletising goods for dispatch
- maintaining dispatch documentation
- manual handling
- selecting and using lifting equipment appropriate to the load
- selecting dispatch procedures and processes, including labelling
- entering information onto manual and electronic workplace documents

#### Required knowledge

Look for evidence that confirms knowledge of:

- relevant legislation, regulations and codes
- checking and recording processes and procedures
- handling of hazardous goods, storage procedures and processes, including labelling
- safe work practices and procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- hazards and control measures associated with undertaking warehouse dispatch processes

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to undertake warehouse dispatch processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with undertaking warehouse dispatch processes or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Packed</b>	<ul style="list-style-type: none"> <li>Wrapping, shrink wrapping, wrapping in bubble wrap, polystyrene packing, pallets, crates/boxes and others</li> <li>Sealing such as packing tape, banding, boxes, pallet racking</li> </ul>
<b>Labelled</b>	Labelling meets requirements of dangerous goods legislation acts and regulations, storage of chemicals/poisons, industry codes of practice, environmental codes etc.
<b>Documentation</b>	Invoice, carrier or supplier documentation
<b>Loading</b>	Special loading procedures may be required with respect to hazardous goods, chemicals/poisons, etc. and for goods where size, shape, fragility require special procedures
<b>Materials handling techniques and devices</b>	Hand trolleys, wheelbarrows, motorised/hand pallet trucks (not sit on), hand carts, dedicated

**RANGE STATEMENT**

	production or process lifting equipment such as baskets, spreader bars, cradles or the like attached to lifting equipment etc.
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11015B Manage warehouse inventory system

### Modification History

Release 2 - Prerequisite unit code corrected - MEM15002A

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers monitoring warehouse record keeping processes, supervising the production of inventory system reports and analysing inventory reports.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the supervision of a warehouse inventory system used by other warehouse, production, maintenance or management personnel. Records can be computer based or manual.</p> <p>If computer based records are used, relevant computer units may also need to be accessed.</p> <p>Where skills are required to maintain/supervise application of quality procedures, then Unit MEM15012C (Maintain/supervise the application of quality procedures) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM11007B	Administer inventory procedures
	MEM15002A	Apply quality systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Monitor warehouse record keeping processes	<p>1.1. Monitoring procedures are developed for requisition, purchase, shipping and invoice documentation.</p> <p>1.2. Discrepancy reporting procedures are established for warehouse and other personnel in accordance with standard operating procedures.</p> <p>1.3. Audit and archive procedures are followed according to standard operating procedures.</p>
2. Supervise production of inventory system reports	<p>2.1. Regular inventory reports are prepared in accordance with standard operating procedures.</p> <p>2.2. Special stock level and other inventory reports are prepared as required.</p> <p>2.3. Adjustments to inventory reporting procedures are made to meet internal and external customer</p>

ELEMENT	PERFORMANCE CRITERIA
	requirements.
3. Analyse inventory reports	<p>3.1.Reconciliation of inventory records against production or purchase of sales records is undertaken in accordance with standard operating procedures.</p> <p>3.2.Major trends not requiring sophisticated statistical analysis are identified.</p> <p>3.3.Inventory system relationship to manufacturing process is understood.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- producing, interpreting and analysing information on requisition, purchase, sales, shipping and invoice documentation, inventory records/reports, discrepancy reports, lists and other applicable reference documents
- accessing/managing manual and electronic information
- undertaking numerical operations and calculations
- organising and analysing inventory information
- communicating with staff about systems
- monitoring warehouse documentation
- reconciling inventory records
- developing inventory monitoring/discrepancy procedure

#### Required knowledge

Look for evidence that confirms knowledge of:

- inventory systems for example JIT, KANBAN, MRP2
- quality procedures
- monitoring and discrepancy processes and procedures
- warehouse organisation principles
- storage of hazardous materials
- auditing procedures
- safe work practices and procedures
- hazards and control measures associated with managing warehouse inventory

**REQUIRED SKILLS AND KNOWLEDGE**

systems

- relationship of manufacturing system to inventory process
- techniques for developing inventory monitoring and discrepancy procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to manage a warehouse inventory system. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with other units addressing the safety, quality, communication, materials handling, recording and reporting associated with managing a warehouse inventory system or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required and be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Monitoring procedures</b>	Loss control, inventory system (paper based or electronic), maximum/minimum limits, rotation
<b>Discrepancy</b>	Inventory numbers, quantity, products, price, damaged goods, delivery date
<b>Inventory system</b>	Just-in-Time, KANBAN, MRP2

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Materials handling
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## MEM11016B Order materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing a purchase/order list and placing the order.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to purchasing activities carried out by a person other than the purchasing officer, such as maintenance, service, stores and warehouse personnel. Approval to order limits and delegations will be included in the standard operating procedures or purchasing policy</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare purchase order/list	1.1.Purchase order/list is prepared to standard operating procedures. 1.2.Material specifications, price limitations, quantities and delivery requirements are determined from instructions, requisitions etc.
2. Purchase order	2.1.Supplier/vendor is informed of requirements and specifications according to standard operating procedures. 2.2.Supplier/vendor is followed up to achieve delivery as required. 2.3.Where appropriate, goods are directly received and checked for damage. 2.4.Records/files are completed accurately according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on instructions, specifications, standard operating procedures, requisitions, lists, records, files and other applicable reference documents
- preparing an order/list
- checking and clarifying order information
- entering information onto manual and electronic proformas and standard workplace forms
- accessing manual and electronic order information
- communicating with suppliers, manufacturers and other personnel
- checking for conformance to specifications
- following verbal instructions
- orally reporting routine information
- record keeping

### Required knowledge

Look for evidence that confirms knowledge of:

- ordering policy (delegations, preferred suppliers etc.)
- ordering procedures
- safe work practices and procedures
- hazards and control measures associated with ordering materials

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to order materials.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency



<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with ordering materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Material specifications</b>	Material specifications can be gained from manufacturers' catalogues, from the item, from a drawing
<b>Supplier/vendor</b>	Local, national, international, preferred supplier

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Materials handling
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## MEM11017B Organise and lead stocktakes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning a stocktake, briefing the participants, generating stocktake reports and adjusting inventory documentation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to organising and leading periodical stocktakes in accordance with enterprise stocktaking policies, practices and procedures. It involves briefing the stocktake participants and reporting on the result.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM11007B	Administer inventory procedures

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan stocktake	1.1.Inventory lists are prepared and distributed. 1.2.Warehouse and/or production areas are allocated to each individual or team assisting in stocktake.
2. Brief participants in stocktake	2.1.Clear directions and appropriate documentation and equipment are provided to each individual or team participating in stocktake.
3. Generate stocktake reports	3.1.Written or computer reports are collected from individuals or teams on stock counts. 3.2.Inventory data is confirmed to match stock levels. 3.3.Stock discrepancy report is prepared and distributed according to standard operating procedure.
4. Adjust inventory documentation	4.1.Inventory documentation is reconciled to match physical stock in accordance with regulatory and operating procedures. 4.2.Stocktake information is reconciled with audit requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing inventory lists and instructions on procedures to be followed
- entering inventory information onto manual and electronic proformas and standard workplace forms
- analysing and reporting results of stocktakes by manual and electronic means
- performing calculations related to reconciling stocktake records
- using communication skills to effectively instruct/direct stocktake participants

#### Required knowledge

Look for evidence that confirms knowledge of:

- relevant inventory systems and procedures
- recording systems and procedures
- analysis and reporting methods/procedures
- audit processes
- safe work practices and procedures
- hazards and control measures associated with organising and leading stocktakes

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to organise and lead a stocktake. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with organising and leading a stocktake or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Directions</b>	Oral or written instructions, methodology, how to report discrepancies or damaged stock, timelines
<b>Equipment</b>	Calculators, scanners and portable computers
<b>Inventory documentation</b>	Reports on actual stock, damaged stock, out of date stock and discrepancies

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Materials handling
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## MEM11018B Organise and maintain warehouse stock receipt and/or dispatch system

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	
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### Application of the Unit

Application of the unit	<p>This unit applies to organising and maintaining warehouse receipt and dispatch areas. It includes the configuration of receipt and dispatch areas, taking into account customer and supplier needs, documentation and system requirements and enterprise quality practices and procedures. Special requirements of products, materials and location are taken into account.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units		
Path 1	MEM11006B	Perform production packaging
	MEM11011B	Undertake manual handling
	MEM11013B	Undertake warehouse receipt process



Prerequisite units		
<b>Path 2</b>	MEM11008B	Package materials (stores and warehouse)
	MEM11011B	Undertake manual handling
	MEM11013B	Undertake warehouse receipt process
<b>Path 3</b>	MEM11006B	Perform production packaging
	MEM11011B	Undertake manual handling
	MEM11014B	Undertake warehouse dispatch process
<b>Path 4</b>	MEM11008B	Package materials (stores and warehouse)
	MEM11011B	Undertake manual handling
	MEM11014B	Undertake warehouse dispatch process

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Allocate/coordinate work activities in receipt and/or dispatch areas	<ul style="list-style-type: none"><li>1.1. Equipment and/or staff are allocated to meet receipt and/or dispatch schedules.</li><li>1.2. Relevant documentation is distributed and collected.</li><li>1.3. Contingency procedures are developed and implemented for receipt and dispatch problems.</li></ul>
2. Maintain stock receipt and/or dispatch system	<ul style="list-style-type: none"><li>2.1. Information is provided and extracted accurately according to standard operating procedures.</li><li>2.2. Receipt and dispatch reports are produced as required.</li><li>2.3. Modifications to dispatch and/or receipt system are made according to standard operating procedures.</li><li>2.4. Problems with receipt and/or dispatch system are identified and reported according to standard operating procedures.</li><li>2.5. Participate in continuous improvement of dispatch and/or receipt systems.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- coordinating staff and equipment for receipt and dispatch
- planning and sequencing operations/activities
- communicating with management and staff
- solving warehouse problems
- producing stock receipt and dispatch reports
- developing and implementing procedures
- accessing, entering and maintaining information on manual and electronic records/files and forms
- checking and clarifying task-related information

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- receipt and dispatch systems
- legislation, regulations, and codes of practice
- inventory systems and procedures
- auditing processes
- quality systems
- warehousing systems
- safe work practices and procedures
- continuous improvement processes and procedures
- hazards and control measures associated with organising and maintaining a warehouse stock receipt and/or dispatch system

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to organise and maintain a warehouse stock receipt and/or dispatch system including allocating/coordinating work activities. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

## EVIDENCE GUIDE

	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with organising and maintaining a warehouse stock receival and/or dispatch system or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Equipment and/or staff</b>	Calculators, scanners and portable computers, drivers, stores assistants, casuals, specialists
<b>Modifications</b>	Extra staff, adjustment of hours, set up special

RANGE STATEMENT	
	storage areas, hire of lifting equipment
<b>Problems</b>	Out of hours receipt, late deliveries or dispatches, dealing with goods that need equipment for loading or unloading, hazardous goods, inadequate stores capacity, emergency procedures, special legislative requirements

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Materials handling
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## MEM11019B Undertake tool store procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers ordering, receiving, maintaining and distributing tooling and specialist tools used in engineering applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the management and storage of enterprise-owned tooling, specialist tools and associated consumable items used in engineering applications and environments. This could include production manufacturing, specialist machining, maintenance and fabrication settings. Tooling may be permanent or disposable. The work would normally be undertaken in a specialist store or warehouse.</p> <p>Engineering knowledge and drawing interpretation skills would often be required due to the specialised nature of engineering tools/tooling and should be accessed from appropriate units.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM11007B	Administer inventory procedures
	MEM11011B	Undertake manual handling
	MEM11013B	Undertake warehouse receipt process
	MEM12024A	Perform computations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Order tools/tooling	<p>1.1. Tools/tooling requirements are identified and consolidated from order documentation, drawings, and liaison with trade and production personnel according to standard operating procedures.</p> <p>1.2. Appropriate tools/tooling are identified from supplier catalogues and manuals, including correct</p>

ELEMENT	PERFORMANCE CRITERIA
	size, hardness, quality etc. 1.3.Order is placed according to standard operating procedures.
2. Receive tool/tooling orders	2.1.Orders are received from main receival warehouse or direct from supplier according to standard operating procedures. 2.2.Orders are unpacked and stock placed in correct location. 2.3.Items are checked and confirmed against order. 2.4.Incorrect items are processed to standard procedures.
3. Maintain tooling	3.1.Tools/tooling are cleaned and protected as necessary. 3.2.Supplies are monitored to ensure maintenance of contingency stock.
4. Distribute tools/tooling	4.1.Tools/tooling are issued to users according to standard operating procedures. 4.2.Enterprise documentation procedures are followed. 4.3.Procedures against unauthorised use of tools/tooling are established and followed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- maintaining documentation
- undertaking stock control
- performing manual handling
- packaging and storing engineering specialist tools and tooling
- cleaning and maintaining engineering tools/tooling
- interpreting specifications, data sheets, drawings, supplier catalogues and manuals for relevant tools/tooling information
- checking and clarifying information

#### Required knowledge



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- types and applications of engineering tooling and specialist engineering tools
- methods of storing and protecting tools/tooling
- ordering procedures
- inventory systems
- procedures for protecting store against unauthorised entry and use of tools/tooling
- safe work practices and procedures
- hazards and control measures associated with tool store activities
- use and application of personal protective equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to undertake tool store procedures in an engineering setting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with undertaking tool store procedures or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Tools/tooling</b>	<ul style="list-style-type: none"> <li>Hand tools, cutting tips for lathes, mills and other machines for metal removal, grinding wheels, special steel etc.</li> <li>Specialist tools include engineering power tools, specialised hand tools, mechanical and electro-mechanical devices (e.g. for lifting, clamping), measuring and marking equipment, templates, jigs etc.</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11020B Perform advanced warehouse computer operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying programs appropriate to the purpose, manipulating data for analysis and/or report generation and editing the program where required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to advanced operations on warehouse computer information systems. It identifies the level of computer skills needed rather than the inventory system or product knowledge required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16008A	Interact with computing technology

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify programs appropriate to purpose	1.1.The range of programs available on the system is identified. 1.2.Correct selection of word processing, spreadsheet, database or special purpose program is made.
2. Manipulate data for analysis and/or report generation	2.1.Data is manipulated through merging of files, transfer of information between programs or other strategies to generate desired outcome.
3. Edit program	3.1.Categories in warehouse information system are created/deleted to cater for changes in stock lines. 3.2.Report formats are generated and/or modified. 3.3.Access control requirements are identified.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- selecting and accessing program appropriate to task
- performing data input and manipulation, editing programs, and formatting reports and production
- identifying required program outputs
- checking and clarifying task-related information
- generating and modifying reports
- producing accurate records related to the warehouse operations

### Required knowledge

Look for evidence that confirms knowledge of:

- application, features/functions and operation of relevant computer programs
- stock control systems
- recording requirements of enterprise
- access control requirements
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to identify programs appropriate to purpose, manipulate data for analysis and/or report generation and edit the program. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where

**EVIDENCE GUIDE**

	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with identifying programs appropriate to purpose, manipulating data for analysis and/or report generation and editing the program or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

RANGE STATEMENT	
<b>Programs</b>	Word processing, spreadsheet, database or special purpose programs
<b>Data</b>	Suppliers, pricing, stock in hand, shortages, invoicing, ordering, budget, reporting
<b>Categories</b>	Stock control, customers, suppliers, address/contact details, billing, debtor information

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Materials handling
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## MEM11021B Perform advanced operation of load shifting equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining lifting and loading requirements, working within areas of restricted movement or conditions of restricted visibility, identifying loads that need special care, and operating forklifts in special traffic conditions.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to advanced forklift and load shifting skills above those required for general operation. To be credited with this unit it is expected that an employee would be competent in situations indicated by all elements and performance criteria.</p> <p>This unit is intended to cover load shifting applications where special-purpose equipment/accessories requiring advanced operational skills are required. This would include heavy, out of balance, awkward and irregular shaped loads traversing over rough, broken or uneven surfaces, high lift situations, extremes of climate.</p> <p>Awareness of licensing requirements: Licenses may be required for load shifting equipment in some jurisdictions</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

Prerequisite units		
Path 1	MEM11010B	Operate mobile load shifting equipment

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine lifting and loading requirements	<p>1.1. Load is identified and checked against safe working load and final position/location and/or relevant specifications or regulations.</p> <p>1.2. Special handling requirements of load are identified, if applicable.</p> <p>1.3. Load is lifted correctly and placed in final position/location to achieve specified balance of</p>

ELEMENT	PERFORMANCE CRITERIA
	load.
2. Work in areas of restricted movement or conditions of restricted visibility	2.1.Load is collected and manoeuvred without damage to load or collision with obstacles according to standard operating procedures.
3. Identify and carry loads that require special care	3.1.Loads requiring special care are identified. 3.2.Loads are carried in accordance with special requirements of product according to standard operating procedures and/or regulations.
4. Operate forklifts in special traffic conditions	4.1.Forklifts are operated in areas of heavy traffic. 4.2.Forklifts are operated over difficult or uneven surfaces. 4.3.Forklifts are operated in areas shared with the general public, as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading/interpreting specifications, regulations, load charts and standard operating procedures, including simple drawings
- selecting appropriate load shifting device
- identifying safe working loads
- identifying/managing special conditions and equipment
- operating in a complex mobile plant environment
- communicating with personnel on movement/location
- following oral instructions

#### Required knowledge

Look for evidence that confirms knowledge of:

- pre-operational checks
- licensing requirements and appropriate permits
- load protection

**REQUIRED SKILLS AND KNOWLEDGE**

- operational environment
- methods and techniques for loads requiring special care
- hazards and control measures associated with this unit
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to operate load shifting equipment in special conditions. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating load shifting equipment in special conditions or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Safe working load**

As defined in the manufacturers' specifications for lifting plant or gear

**Loads requiring special care**

- Non-standard load configuration
- Fragile loads
- Dangerous (volatile, explosive, sensitive)
- Raising and lowering personnel on approved work platforms (forklift only)

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11022B Operate fixed/moveable load shifting equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers conducting routine operation and safety checks of fixed/moveable load shifting equipment, picking up loads, shifting and placing loads.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the operation of fixed/moveable load shifting equipment within the limits of manufacturers' recommended procedures and safe working loads. It applies to load shifting/lifting activities where knowledge of codes and signals is not required.</p> <p>When using dedicated lifting equipment or devices where decisions regarding loads and methods of attachment are not required, Unit MEM11011B (Undertake manual handling) should be selected.</p> <p>Awareness of licensing requirements - licenses may be required for fixed/moveable load shifting equipment in some jurisdictions.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Conduct routine operation and safety checks of load shifting equipment	1.1. Operational principles of fixed/moveable load shifting equipment are understood. 1.2. Routine pre-operational checks are undertaken in accordance with manufacturers' specifications and regulatory safety requirements. 1.3. Non-compliance with specifications is reported using standard operating procedures.
2. Pick up loads	2.1. Appropriate load shifting device is selected for the load and shifting requirements. 2.2. Load shifting device is operated within design specifications and safe working load. 2.3. Load is lifted/rolled, ensuring balance, vision of



ELEMENT	PERFORMANCE CRITERIA
	operation, safety of personnel and protection of load.
3. Shift loads	3.1. Where required, load is moved at an appropriate and safe speed using a safe and efficient path. 3.2. Path of movement is monitored for obstacles and hazards during shifting process.
4. Place loads	4.1. Loads are lowered at an appropriate and safe rate. 4.2. Loads are placed to ensure stability, protection of material and avoidance of hazards on site.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting routine information on instructions, specifications, load charts and standard operating procedures. May include simple drawings
- selecting and operating appropriate load shifting device
- communicating with others about movement of equipment
- checking and clarifying task-related information
- identifying the safe working load in relation to the capacity of the crane and lifting gear
- following oral instruction
- safely lifting, moving and placing loads

#### Required knowledge

Look for evidence that confirms knowledge of:

- operational principles of fixed/moveable load shifting equipment
- pre-operational checks
- loads and lifting attachments
- load chart and safe working loads (SWL)
- awareness of licensing requirements
- load protection
- operational environment
- appropriate permits

**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with operating fixed/moveable load shifting equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to operate fixed/moveable load shifting equipment to move and place loads.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating fixed/moveable load shifting equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Fixed/moveable load shifting equipment</b>	<ul style="list-style-type: none"> <li>• Pendant cranes</li> <li>• Yard, workshop and travelling overhead cranes</li> <li>• Monorail hoists and chain blocks</li> <li>• Pivoting and slewing jibs rails (manual, air or electric etc.)</li> </ul>
<b>Pre-operational checks</b>	Hazards warning lights, wire rope, lifting blocks, compass, operation of controls, safe working load marked as determined by manufacturers' specifications and standard operating procedures
<b>Obstacles and hazards</b>	Overhead cables, electrical hazards (live rails), personnel, obstacles (fixed and moveable), swing of the load and failure of slings

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Materials handling
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## MEM11023A Operate a bridge and gantry crane

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency applies to the operation of bridge and gantry cranes that are operated from a permanent cabin/control station on the crane.

### Application of the Unit

This unit applies to operation of a bridge and gantry crane in a manufacturing related environment, such as a factory, raw material or finished goods store. It covers safe and efficient operation of the crane and applies where the operator has responsibility to plan the work, transfer loads as well as the conduct of routine checks and shutting down and securing of the crane.

This unit does not cover the bridge and gantry crane types that are controlled from a location remote to a permanent cabin/control station on the crane and that have three or less powered operations, that is hoist/raise and lower in one operation. It also does not cover the slinging or rigging of loads.

While this unit applies to work covered by licensing requirements, it also includes other manufacturing related skills, such as integrating crane operations with production, jobbing, maintenance or warehouse operations.

This unit is not recognised by regulators for licensing requirements. In order to satisfy licensing requirements, the imported unit TLILIC3003A Licence to operate a bridge and gantry crane will be required.

Band A

Unit Weight 4

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |                          |   |
|--------------------------|---|
| 1 Plan work              | <ul style="list-style-type: none"><li>1.1 Load transfer authorisation is obtained, including lift time and load destination</li><li>1.2 Potential hazards for load lift and transfer are identified</li><li>1.3 Hazard control measures are identified consistent with appropriate standards to ensure the safety of personnel and equipment</li><li>1.4 Weight (mass) of the load is estimated in consultation with associated personnel</li><li>1.5 Appropriate paths for the movement of loads in the work area are determined</li><li>1.6 Crane capacity is checked as appropriate to the load</li><li>1.7 Appropriate communication methods are identified with associated personnel</li></ul> |
| 2 Conduct routine checks | <ul style="list-style-type: none"><li>2.1 Appropriate hazard prevention/control measures are applied to the work area according to procedures</li><li>2.2 Crane is accessed in a safe manner</li><li>2.3 Crane is visually checked for any damage or defects</li><li>2.4 All signage and labels are visible and legible according to the appropriate standard</li><li>2.5 Routine pre-operational crane checks are carried out according to procedures</li><li>2.6 All controls are located and identified</li></ul>  |

- 2.7 Crane service logbook is checked for compliance
- 2.8 Crane is started according to procedures and checked for any abnormalities
- 2.9 Crane safety devices are tested according to procedures
- 2.10 Post-start operational checks are carried out according to procedures
- 2.11 All communication equipment is checked for serviceability
- 2.12 All damage and defects are reported and recorded according to procedures, and appropriate action is taken
- 3 Transfer loads
  - 3.1 Hoist block is positioned over load following directions from associated personnel
  - 3.2 Test lift is carried out according to procedures
  - 3.3 Loads are transferred along planned path
  - 3.4 All crane movements are according to procedures and the appropriate standard
  - 3.5 Communication signals are interpreted correctly according to procedures and the appropriate standard
  - 3.6 Crane is operated according to procedures
  - 3.7 Load movements are monitored constantly ensuring safety to personnel and load, and structural stability
  - 3.8 Unplanned and/or unsafe situations are responded to in line with procedures
- 4 Shut down and secure crane
  - 4.1 Crane is parked according to procedures
  - 4.2 Crane and equipment are stowed and secured according to procedures and the appropriate standard
  - 4.3 All relevant motion locks and brakes are applied, where applicable
  - 4.4 Crane is shut down according to procedures
  - 4.5 Routine post-operational crane checks are carried out according to procedures
  - 4.6 Hazard prevention/control measures are removed, where applicable

- 4.7 All damage and defects are reported and recorded according to procedures, and appropriate action is taken

## Required Skills and Knowledge

Required knowledge includes:

- appropriate mathematical procedures for estimation of loads
- bridge and gantry crane characteristics
- federal, state or territory occupational health and safety (OHS) legislation, standards and codes of practice relevant to the full range of processes for the crane class
- emergency procedures, including escape routes
- the hierarchy of hazard identification and control
- organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- typical hazards in manufacturing related environments, including:
  - process areas that must be avoided, ceased or special procedures adopted before load transfers occur, including welding, machining, melting and casting
  - transfers across areas frequented by personnel, including workstations and walkways
  - hazardous loads, including hot or liquid metals, chemicals, heavy and non-standard shaped loads
- procedures for the recording, reporting and maintenance of workplace records and information
- typical routine problems encountered in the operation of the crane and equipment and adjustments required for correction

Required skills include:

- accurately recording and maintaining information relating to bridge and gantry crane operations
- using communication techniques in the workplace, including hand signals, whistles and two-way radios
- using interpersonal and communication skills at a level sufficient to communicate with other site personnel
- operating a bridge and gantry crane, including all functions to their maximum for the lifting and moving of loads to the maximum rated capacity, in conjunction with other associated personnel
- applying risk assessment and hazard control strategies, including hierarchy of control, as applied to the safe operation of the crane (particular awareness of the risks associated with the workplace, including location of utilities, such as overhead powerlines, other electrical cables, water and compressed air lines, access to cabin, location of equipment, fixtures and workstations, vehicles and clear access whilst travelling)
- planning load transfer paths for safety and efficiency in a manufacturing related environment



- using and interpreting crane manufacturer specifications and data, including maximum load information, to ensure the crane is not overloaded
- identifying problems and equipment faults and demonstrating appropriate response procedures
- reading and comprehending manufacturer instructions, procedures and safety signs

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to operate a bridge and gantry crane to industry and enterprise standards, manufacturer specifications, and in accordance with safety regulations and procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• comply with OHS licensing legislation</li> <li>• communicate and work safely with others in the work area</li> <li>• apply risk assessment and management procedures (particular awareness of the risks associated with overhead powerlines/electrical cables, access to cabin, other personnel and equipment in the work area, including vehicles and clear access whilst travelling)</li> <li>• conduct pre- and post-operational checks of the bridge and gantry crane</li> <li>• operate a bridge and gantry crane, including all functions to their maximum capacity in the lifting and moving of loads to the maximum rated capacity, in conjunction with other associated personnel</li> <li>• apply appropriate mathematical procedures for estimation of loads.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</li> <li>• Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Assessment is to comply with relevant appropriate standard requirements.</li> <li>• Applicants must have access to: <ul style="list-style-type: none"> <li>• personal protective equipment for the purpose of the Performance Assessment</li> <li>• appropriate bridge and gantry crane and associated equipment in safe condition</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• suitable loads as specified by the endorsed Assessment Instrument</li><li>• communication equipment (e.g. two-way radios and whistles)</li><li>• other associated personnel to sling and direct the loads.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• The use of 'simulators' in the assessment of this unit of competency is not acceptable.</li><li>• Assessment may be in conjunction with the assessment of other units of competency.</li><li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li><li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li></ul>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Hazards</b>	<p>Hazards may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• ground stability (e.g. ground condition or slopes for load placement)</li> <li>• overhead hazards (e.g. powerlines and service pipes)</li> <li>• insufficient lighting</li> <li>• traffic (e.g. pedestrians, vehicles and plant)</li> <li>• environmental conditions (e.g. dust, wind, lightning and storms)</li> <li>• other specific hazards (e.g. dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Hazard control measures refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <p>elimination substitution isolation engineering control measures using safe work practices personal protective equipment</p>
<b>Appropriate standards</b>	<p>Appropriate standards may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards</li> <li>• crane manufacturer specifications</li> <li>• industry and workplace standards, where applicable</li> </ul>
<b>Appropriate paths</b>	<p>Appropriate paths are paths that:</p> <ul style="list-style-type: none"> <li>• ensure clearances of fixed machinery, equipment, fixtures and work in progress</li> <li>• minimise transfers across workstations and walkways</li> <li>• minimise disruption to work unrelated to the load transfer</li> <li>• minimise transfer time and distance subject to safety and disruption assessments</li> </ul>
<b>Associated personnel</b>	<p>Associated personnel may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• riggers</li> <li>• doggers</li> <li>• supervisory and expert personnel to advise on any</li> </ul>

	special features of the load or transfer
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<b>Crane</b>	<p>Crane may include:</p> <ul style="list-style-type: none"> <li>• bridge crane, a bridge beam mounted at each end to an end carriage, capable of travelling along elevated runways and having one or more hoisting mechanisms arranged to traverse across the bridge</li> <li>• gantry crane, a bridge beam, supported at each end by legs mounted on end carriages, capable of travelling on supported surfaces or deck levels, whether fixed or not and which has a crab with one or more hoisting units arranged to travel across the bridge</li> </ul> <p>Bridge and gantry:</p> <ul style="list-style-type: none"> <li>• excluded are cranes of the type that are controlled from a location remote to a permanent cabin/control station on the crane and that have three or less powered operations, that is hoist raise and lower is one operation</li> </ul>
<b>Communication methods</b>	<p>Communication methods may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding</li> <li>• appropriate worksite protocol</li> </ul>
<b>Signage and labels</b>	<p>Signage and labels may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• crane data plates/labels</li> <li>• load charts</li> <li>• crane decals</li> <li>• control labels</li> </ul>
<b>Procedures</b>	<p>Procedures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• manufacturer guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures</li> <li>• workplace procedures (work instructions, operating procedures and checklists)</li> </ul>
<b>Controls</b>	<p>Controls may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• long travel levers</li> <li>• cross travel levers</li> <li>• hoisting and lowering levers</li> <li>• rotating hook levers, where applicable</li> </ul>

<b>Service logbook</b>	<p>Service logbook may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• any logbook</li> <li>• service book</li> <li>• history record system where the service and maintenance history is kept</li> </ul>
<b>Safety devices</b>	<p>Safety devices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• horns/sirens</li> <li>• audible and visual motion devices</li> <li>• operator restraint devices, where applicable</li> <li>• lights</li> </ul>
<b>Communication equipment</b>	<p>Communication equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• two-way radios</li> <li>• whistles</li> <li>• bells</li> <li>• buzzers</li> </ul>
<b>Hazard prevention/control measures</b>	<p>Hazard prevention/control measures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• traffic barricades and controls</li> <li>• pedestrian controls</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> </ul>
<b>Test lift</b>	<p>Test lift means the load is lifted just clear of the lifting plane to allow for checks to be safely made in consultation with associated personnel to ensure that:</p> <ul style="list-style-type: none"> <li>• near capacity loads do not overload the crane</li> <li>• loads of unusual shape or weight distribution are correctly slung</li> <li>• load measuring equipment can be used to verify the calculated weight of the load</li> <li>• all crane equipment is functioning properly</li> <li>• adjustments to the slinging can be made in a safe manner</li> </ul>
<b>Relevant crane movements</b>	<p>Relevant crane movements may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• hoisting (raise and lower)</li> <li>• traversing (moving hoisting mechanisms along</li> </ul>

	bridge) <ul style="list-style-type: none"> <li>travelling (at minimum speed, gentle acceleration and braking, to minimise load swing)</li> </ul>
<b>Communication signals</b>	Communication signals may include, but are not limited to: <ul style="list-style-type: none"> <li>stop - hand</li> <li>stop - whistle</li> <li>hoist up - hand</li> <li>hoist up - whistle</li> <li>hoist down - hand</li> <li>hoist down - whistle</li> <li>traverse - hand</li> <li>travel - hand</li> <li>creep - hand</li> </ul>
<b>Unplanned and/or unsafe situations</b>	Unplanned and/or unsafe situations may include, but are not limited to: <ul style="list-style-type: none"> <li>failure/loss of control (e.g. brakes and steering)</li> <li>failure of equipment (e.g. hydraulic system)</li> <li>environmental conditions (e.g. wind, lightning and storms)</li> </ul>
<b>Shutdown</b>	Shutdown may include, but is not limited to: <ul style="list-style-type: none"> <li>retracting hoist rope and hook block</li> <li>travelling crane to park position</li> <li>removing key from control panel, where applicable</li> <li>locking and securing cabin, where applicable</li> <li>isolating power to crane</li> </ul>

## Unit Sector(s)

Materials handling

## Custom Content Section

Not applicable.



## MEM11024A Undertake basic rigging

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency applies to basic rigging in a manufacturing or related enterprise. It includes rigging work associated with movement of plant and equipment and temporary or permanent steel structures, such as platforms, access ways and ladders, hoppers and bins, and conveyors.

### Application of the Unit

This unit requires the learner to be able plan the work, select and inspect equipment, set up tasks, and erect and/or dismantle the required equipment or structures. Work will often be required to be undertaken with other employees especially tradespersons, bridge and gantry and mobile crane drivers, and doggers.

This unit does not cover the slinging of loads which is covered in MEM11004B Undertake dogging, or the skills associated with fabrication and welding of metal structures or components. Where erection, alteration or dismantling of scaffolding is undertaken, the units MEM11001C Erect/dismantle scaffolding and equipment, or MEM11002C Erect/dismantle complex scaffolding and equipment, should be selected.

While this unit applies to work covered by licensing requirements, it also includes other manufacturing related skills, such as integrating rigging with welding, fabrication, production, jobbing, maintenance or warehouse operations.

This unit is not recognised by regulators for licensing requirements. In order to satisfy licensing requirements, the imported unit CPCCLRG3001A Licence to perform rigging basic level will be required.

Band A

Unit Weight 4

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM11004B	Undertake dogging
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## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |                                |   |
|--------------------------------|---|
| 1 Assess rigging site          | <ul style="list-style-type: none"><li>1.1 Rigging to be undertaken is identified and assessed from supervisor's instructions, drawings and other appropriate sources</li><li>1.2 Equipment and processes in close proximity to rigging site are identified and need for protection, shielding or closure during rigging identified with appropriate personnel</li><li>1.3 Other potential workplace hazards and appropriate hazard control measures are identified</li><li>1.4 Site information is obtained</li><li>1.5 Rigging equipment and associated equipment, including safety equipment available on site, is identified</li></ul> |
| 2 Plan rigging work            | <ul style="list-style-type: none"><li>2.1 All forces and loads associated with erecting and dismantling structures and associated equipment are considered in consultation with appropriate personnel</li><li>2.2 Required safety equipment for rigging task is identified</li><li>2.3 Procedures for minimising disruption to other site processes are considered</li><li>2.4 Appropriate communication methods are identified with appropriate personnel</li></ul>  |
| 3 Select and inspect equipment | <ul style="list-style-type: none"><li>3.1 Rigging equipment and associated equipment is selected and inspected according to procedures and the appropriate standard</li></ul>   |

- 3.2 Required safety equipment is selected and inspected according to procedures
- 3.3 All defective rigging equipment, associated equipment and safety equipment is isolated, reported and recorded according to procedures
- 3.4 Where applicable, communication equipment is selected and inspected for serviceability
- 4 Set up rigging task
  - 4.1 Appropriate hazard prevention or control measures are applied to the work area according to procedures
  - 4.2 Ground suitability is inspected and checked where appropriate
  - 4.3 Site information is reviewed and interpreted with appropriate personnel
  - 4.4 All forces and loads associated with erecting and dismantling structures and associated plant are determined and compared with planned forces and loads in consultation with appropriate personnel
  - 4.5 Required adjustments for actual forces and loads are made to rigging plan, rigging equipment, associated equipment and safety equipment
  - 4.6 Personal safety equipment is fitted and worn correctly
  - 4.7 Rigging equipment and associated plant are positioned for work application and stability according to procedures
  - 4.8 Methods of applying temporary connections using fibre rope are applied according to procedures and the appropriate standard
- 5 Erect, move or dismantle structures, plant or equipment
  - 5.1 Structures, plant or equipment are erected, moved or dismantled according to procedures and site information
  - 5.2 Stability of structures, plant or equipment is maintained during erection, movement or dismantling
  - 5.3 Where height work is required, safety procedures are followed, including safe and effective use of safety equipment
  - 5.4 Appropriate communication methods and communication equipment are used to coordinate the rigging tasks
  - 5.5 Associated plant and equipment are used according to

procedures and the appropriate standard

5.6 Temporary guys, ties, propping and shoring, including flexible steel wire rope and tubing, are connected where required

5.7 Procedures are followed to minimise disruption to other site operations

5.8 The completed task is inspected according to the appropriate standard

6 Finalise rigging task 6.1 Approval for completion of rigging task is obtained according to site or enterprise procedures

6.2 Excess materials are removed from the work area, where applicable

6.3 Rigging equipment, associated equipment, safety equipment and associated plant used during rigging task are inspected for damage and defects

6.4 All defective rigging equipment, associated equipment, associated plant and safety equipment are isolated reported and recorded according to procedures

6.5 Rigging equipment and associated equipment are stored according to procedures and the appropriate standard

6.6 Hazard prevention/control measures are removed, where appropriate

## Required Skills and Knowledge

Required knowledge includes:

- appropriate mathematical procedures for estimation and measurement of loads
- principles relating to all plant, equipment and structural stability
- types and functions of rigging, safety and associated equipment, including an understanding of their limitations
- organisational and workplace standards, requirements, policies and procedures for rigging
- the hierarchy of hazard identification and control
- sources of specialist knowledge and support in typical manufacturing sites, including engineers, technicians, tradespersons, and supervisors and managers
- relevant federal, state or territory and local government occupational health and safety (OHS) legislation, standards and codes of practice for undertaking rigging activities
- inspection and maintenance requirements of a wide range of appropriate plant and

equipment in line with Australian standards or manufacturer specifications

- minimum clearance distances from powerlines or electrical equipment as determined by the relevant state or territory authority or electrical supply authority
- estimation of ground bearing pressures of the full range of soil types and associated ground conditions for setting up plant and equipment

Required skills include:

- calculating safe working load (SWL) and working load limit (WLL)
- erecting and dismantling, levelling, plumbing and stabilising associated plant, equipment and structures
- working safely at heights, including the correct application of safety equipment
- accurately interpreting basic drawings, sketches and site plans
- applying methods for making temporary connections of ropes using fibre and synthetic types
- applying methods of splicing and whipping fibre and synthetic ropes
- correctly applying and using all rigging and associated equipment
- working with tradespersons on manufacturing related installation and removal of structures, plant and equipment
- applying risk assessment and hazard control strategies, including hierarchy of control
- interpreting manufacturer specifications for all plant and equipment use in rigging operations
- using interpersonal and communication skills at a level sufficient to determine site/workplace requirements, including the relevant communication methods and equipment
- verifying problems and equipment faults and demonstrate appropriate response

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake rigging to industry and enterprise standards, manufacturer specifications, and in accordance with safety regulations and procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• comply with OHS licensing legislation</li> <li>• effectively communicate and work safely with others in the work area, including tradespersons, doggers and crane operators</li> <li>• effectively conduct risk assessment and management procedures</li> <li>• effectively complete the following tasks: <ul style="list-style-type: none"> <li>• inspection of relevant plant and equipment</li> <li>• installation of a fall arrest system (static line)</li> <li>• use of a safety harness/fall arrest system</li> <li>• installation of a safety net</li> <li>• installation safety screens</li> </ul> </li> <li>• work safely at heights</li> <li>• erect and dismantle structures,</li> <li>• move and correctly locate plant and equipment</li> <li>• effectively demonstrate the following knots, bends and hitches: <ul style="list-style-type: none"> <li>• sheet bend</li> <li>• becket hitch</li> <li>• running bowline</li> <li>• double bowline</li> </ul> </li> <li>• effectively demonstrate the following splices and whippings: <ul style="list-style-type: none"> <li>• eye splice</li> <li>• back splice</li> <li>• short splice</li> <li>• sail makers whipping</li> <li>• common whipping</li> <li>• west countryman's.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessors must ensure that the assessment in the workplace is organised to ensure that all the required</li> </ul>

	<p>equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</p> <ul style="list-style-type: none"> <li>• Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Assessment is to comply with the requirements of any relevant standards or operating procedures for basic rigging.</li> <li>• Applicants must have access to: <ul style="list-style-type: none"> <li>• personal protective equipment for the purpose of the Performance Assessment</li> <li>• appropriate safety equipment in safe condition</li> <li>• appropriate rigging equipment, associated equipment associated plant in safe condition as described in the endorsed Assessment Instrument</li> <li>• communication equipment (e.g. two-way radios) where applicable</li> <li>• appropriate materials as required for safe erection of structures</li> <li>• appropriate materials for conducting fibre rope slicing, whipping, knots, bends and hitches.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• The use of 'simulators' in the assessment of this unit of competency is not acceptable.</li> <li>• Assessment may be in conjunction with the assessment of other units of competency.</li> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Hazards</b>	<p>Hazards may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• poor condition of ground surfaces and attachment points</li> <li>• utility related hazards, including powerlines and conduits, gas and compressed air pipes, water and drainage services</li> <li>• site or external traffic (e.g. pedestrians and vehicles)</li> <li>• proximity to operating machinery unable to be stopped/isolated, including conveyors, boilers and transformers</li> <li>• restricted access</li> <li>• insufficient lighting</li> <li>• environmental conditions (e.g. wind, lightning and storms)</li> <li>• other specific hazards (e.g. proximity to dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Hazard control measures refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls consistent with appropriate standards.</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <p>elimination substitution isolation engineering control measures using safe work practices personal protective equipment</p>
<b>Appropriate standards</b>	<p>Appropriate standards may include:</p> <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards</li> <li>• manufacturer specifications</li> <li>• industry and enterprise standards, where applicable</li> </ul>
<b>Site information</b>	<p>Site information may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• other work activities and equipment adjacent to or near area where rigging work is to be undertaken</li> <li>• location of services</li> <li>• ground surfaces and attachment points (e.g. concrete, steel plates and platform, columns and beams)</li> </ul>



	<ul style="list-style-type: none"><li>• local conditions, such as access and egress</li><li>• work method statements</li><li>• site-specific job safety analyses and other site-specific documentation as required</li><li>• task plans/schedules and structural plans</li></ul>
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<b>Procedures for minimising disruption</b>	<p>Procedures for minimising disruption may include:</p> <ul style="list-style-type: none"> <li>• in conjunction with crane operators and doggers, planning of routes for load movements to avoid workstations, operating machinery, and walkways and roadways</li> <li>• coordinating rigging with other processes/adjacent sections to minimise downtime</li> <li>• planning rigging for efficient use of shared resources (e.g. bridge and gantry cranes)</li> </ul>
<b>Forces and loads</b>	<p>Forces and loads may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• dead loads</li> <li>• live loads</li> <li>• static load</li> <li>• dynamic loads</li> <li>• wind loads</li> </ul>
<b>Structures</b>	<p>Structures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• structural steel</li> <li>• steel plate and mesh</li> <li>• bins and hoppers</li> <li>• conveyor components</li> <li>• machinery and equipment</li> <li>• non-metallic equipment and components, including concrete, plastic and ceramic items, that need to be placed or erected on site</li> </ul>
<b>Associated plant</b>	<p>Associated plant may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• static lines</li> <li>• safety nets</li> <li>• temporary and permanent hoists</li> <li>• mast climbers</li> <li>• loading platforms</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• other riggers</li> <li>• engineers</li> <li>• supervisors</li> <li>• technicians</li> <li>• mechanical, electrical and fabrication tradespersons</li> <li>• crane operators and doggers</li> <li>• forklift drivers</li> <li>• other workplace personnel who are authorised to take responsibility for supervising or assisting the rigging operation</li> </ul>

<b>Rigging equipment</b>	<p>Rigging equipment may include, but is not limited to:</p> <ul style="list-style-type: none"><li>• scaffolds</li><li>• elevated work platforms</li><li>• safety screens and shutters</li><li>• cranes:<ul style="list-style-type: none"><li>• non-slewing cranes</li><li>• mobile slewing cranes</li><li>• vehicle loading cranes</li><li>• bridge and gantry cranes</li></ul></li><li>• fixed and temporary hoists</li></ul>
<b>Associated equipment</b>	<p>Associated equipment may include, but is not limited to:</p> <ul style="list-style-type: none"><li>• all types of power and manually operated lifting gear</li><li>• fibre ropes</li><li>• flexible steel wire rope (FSWR)</li><li>• chains</li><li>• wire and synthetic slings</li><li>• shackles</li><li>• terminations</li><li>• wedge sockets</li><li>• eye bolts</li><li>• beam clamps</li><li>• plate clamps</li><li>• rope grips</li><li>• turnbuckles</li><li>• rigging screws</li><li>• chain blocks</li><li>• lever blocks</li><li>• lever-action winches</li><li>• sheaves</li><li>• spreader bars</li><li>• lifting beams</li><li>• jacks</li><li>• levers</li><li>• skates</li><li>• wedges</li><li>• rollers</li><li>• girder trolley</li></ul>
<b>Procedures</b>	<p>Procedures may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• manufacturer guidelines (instructions, specifications or checklists)</li><li>• industry operating procedures, including relevant</li></ul>

	<p>codes of practice</p> <ul style="list-style-type: none"><li>• workplace procedures (work instructions, operating procedures and checklists)</li></ul>
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<b>Safety equipment</b>	<p>Safety equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• safety harness</li> <li>• energy absorber</li> <li>• lanyard</li> <li>• inertia reel</li> <li>• static safety lines</li> <li>• safety nets</li> </ul>
<b>Communication methods</b>	<p>Communication methods may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding and appropriate worksite protocol</li> </ul> <p>NB: Mobile phones are not to be used for signalling purposes during the rigging process</p>
<b>Communication equipment</b>	<p>Communication equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• fixed channel two-way radios</li> <li>• in-place intercom and other communication systems</li> </ul>
<b>Hazard prevention/control measures</b>	<p>Hazard prevention/control measures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• powerlines are insulated</li> <li>• safety observer used inside exclusion zone</li> <li>• power disconnected</li> <li>• traffic barricades and control</li> <li>• pedestrian barricades</li> <li>• trench covers</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> <li>• safety shutters and screens</li> </ul>
<b>Ground suitability</b>	<p>Ground suitability may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• bitumen</li> <li>• concrete</li> <li>• suspended concrete floors</li> <li>• earth floor</li> <li>• building roofs</li> </ul>

	<ul style="list-style-type: none"><li>• landings</li><li>• ground bearing pressure</li></ul>
<b>Temporary connections</b>	Temporary connections may include, but are not limited to <ul style="list-style-type: none"><li>• knots</li><li>• bends</li><li>• hitches</li><li>• spicing</li><li>• whipping</li></ul>
<b>Flexible steel wire rope (FSWR)</b>	FSWR includes: <ul style="list-style-type: none"><li>• identification, uses and connections</li></ul> May include termination for: <ul style="list-style-type: none"><li>• static lines</li><li>• guys</li><li>• purchase systems</li><li>• lashing</li><li>• cranes</li><li>• hoist and winch ropes</li></ul>

## Unit Sector(s)

Materials handling

## Custom Content Section

Not applicable.

## **MEM11025A Operate a non-slewing mobile crane of greater than three tonnes capacity**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency applies to the operation of non-slewing mobile cranes of greater than three tonnes capacity that incorporate a boom or jib. The mobile cranes may be articulated or non-articulated truck or locomotive cranes.

### **Application of the Unit**

This unit applies to the operation of non-slewing mobile cranes of over three tonnes capacity in a manufacturing environment. The cranes are often referred to as yard cranes and require the crane to be moved for positioning in lifting and lowering loads. The unit can also be used to cover the operation of a non-slewing crane mounted on a self-propelled or locomotive drawn rail vehicle inside a large manufacturing enterprise.

The unit requires the operator to plan the work, conduct routine checks, set up the crane and coordinate with other employees (including truck drivers, production staff and stores staff) transfer loads, and shut down and secure the crane.

This unit is not recognised by regulators for licensing requirements. In order to satisfy licensing requirements, the imported unit TLILIC3006A Licence to operate a non-slewing mobile crane (greater than three tonnes capacity) will be required.

Band A

Unit Weight 4

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |                          |   |
|--------------------------|---|
| 1 Plan work              | <ul style="list-style-type: none"><li>1.1 Potential workplace hazards are identified</li><li>1.2 Hazard control measures are identified consistent with appropriate standards to ensure the safety of personnel and equipment</li><li>1.3 Requirement for load lifting and/or transfer is obtained according to procedures</li><li>1.4 The weight of the load is identified and estimated in consultation with associated personnel</li><li>1.5 Crane is assessed as appropriate to the load and workplace conditions</li><li>1.6 An appropriate path for the movement of loads in the work area is inspected and determined</li><li>1.7 Appropriate communication methods are identified with associated personnel</li></ul> |
| 2 Conduct routine checks | <ul style="list-style-type: none"><li>2.1 Crane is visually checked for any damage or defects</li><li>2.2 Crane is accessed in a safe manner</li><li>2.3 All signage and labels are visible and legible according to the appropriate standard</li><li>2.4 Routine pre-operational crane checks are carried out according to procedures</li><li>2.5 All controls are located and identified</li><li>2.6 Crane service logbook is checked for compliance</li><li>2.7 Crane is started according to procedures and checked for any abnormal noises</li><li>2.8 All crane safety devices are tested according to procedures</li></ul>   |



- 2.9 Post-start operational checks are carried out according to procedures
- 2.10 All communication equipment is checked for serviceability
- 2.11 All damage and defects are reported and recorded according to procedures, and appropriate action is taken
- 3 Set up crane
  - 3.1 Ground suitability is checked
  - 3.2 Crane is driven to the work area according to procedures
  - 3.3 Crane is positioned for work application and stability according to procedures
  - 3.4 Appropriate crane configuration for work task is determined according to procedures
  - 3.5 Boom or jib and counterweight configuration data is input into the crane computer, where applicable
  - 3.6 Appropriate hazard prevention or control measures are applied to the work area according to procedures
  - 3.7 All communications equipment is tested for functionality
- 4 Lift and transfer load
  - 4.1 Lifts are determined within the capacity of the crane and environmental conditions
  - 4.2 Boom or jib and hoist block is positioned over load following directions from associated personnel
  - 4.3 Test lift is carried out according to procedures
  - 4.4 Loads are lifted and where required transferred or mobiled using all relevant crane movements according to procedures and the appropriate standard
  - 4.5 Appropriate path is followed where load is transferred or mobiled
  - 4.6 All required communication signals are correctly interpreted according to procedures and the appropriate standard
  - 4.7 Load movement is monitored constantly ensuring safety to personnel and stability of load and crane
  - 4.8 Unplanned and unsafe situations are responded to in line with procedures
- 5 Shut down and secure crane
  - 5.1 Crane boom or jib and associated equipment is stowed and secured according to procedures and the appropriate standard

- 5.2 Relevant motion locks and brakes are applied, where applicable
- 5.3 Outriggers/stabilisers are stowed and secured according to procedures, where applicable
- 5.4 Crane is shut down according to procedures
- 5.5 Routine post-operational crane checks are carried out according to procedures
- 5.6 Plates or packing are stowed and secured, where applicable
- 5.7 All damage and defects are recorded and reported according to procedures, and appropriate action is taken

## Required Skills and Knowledge

Required knowledge includes:

- appropriate mathematical procedures for estimation and measurement of loads
- federal, state or territory occupational health and safety (OHS) legislation, standards and codes of practice relevant to the full range of processes for the crane class
- crane characteristics and capabilities, including use of load charts, to allow the configuration of the crane to suit the range of loads
- the hierarchy of hazard identification and control
- organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- procedures for the recording, reporting and maintenance of workplace records and information
- typical routine problems encountered in the operation of the crane and equipment and adjustments required for correction

Required skills include:

- accurately recording and maintaining information relating to crane operations
- using communication techniques in the workplace, including whistles, hand signals and two-way radios
- using interpersonal communication skills at a level sufficient to communicate with other site personnel
- assessing ground conditions to confirm that the site is suitable (e.g. firm, level and safe) to operate crane
- liaising with others to ensure crane working combines efficiently with other enterprise operations (e.g. production, receiving or despatch activities)
- operating crane, including all functions to their maximum extension in the lifting and moving of loads to the safe working rated capacity, in conjunction with other associated personnel

- undertaking mobile load transfers where load is lifted and transferred to a different location by the crane
- applying risk assessment and hazard control strategies, including hierarchy of control as applied to the positioning and safe operation of the crane, in particular, awareness of the risks associated with overhead powerlines/electrical cables, ground conditions, crane tipping and demolition sites
- using and interpreting crane manufacturer specifications and data, including load charts, to enable the crane to be configured for the load
- verifying problems and equipment faults and demonstrating appropriate response procedures
- reading and comprehending manufacturer instructions, procedures and safety signs

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to operate a non-slewing mobile crane of greater than three tonnes capacity to industry and enterprise standards, manufacturer specifications, and in accordance with safety regulations and procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• comply with OHS licensing legislation</li> <li>• communicate and work safely with others in the work area</li> <li>• apply risk assessment and management procedures (particular awareness of the risks associated with overhead powerlines/electrical cables, ground conditions, crane tipping, other vehicles and personnel)</li> <li>• operate a non-slewing mobile crane, including all functions to their maximum extension in the lifting and moving of loads to the safe working rated capacity of non-slewing mobile cranes (over three tonnes capacity), in conjunction with other associated personnel</li> <li>• use appropriate mathematical procedures for estimation of loads</li> <li>• conduct lifts and transfers to designated locations and via appropriate paths.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.</li> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</li> <li>• Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Assessment is to comply with relevant appropriate standard requirements.</li> <li>• Applicants must have access to:</li> </ul>

	<ul style="list-style-type: none"> <li>• personal protective equipment for the purpose of the Performance Assessment</li> <li>• appropriate non-slewing crane (greater than three tonnes) and associated equipment in safe condition</li> <li>• suitable loads as specified by endorsed Assessment Instrument</li> <li>• communication equipment (e.g. two-way radios and whistles)</li> <li>• other associated personnel to sling and direct the loads.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• The use of ‘simulators’ in the assessment of this unit of competency is not acceptable.</li> <li>• Assessment may be in conjunction with the assessment of other units of competency.</li> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstances, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Hazards</b>	<p>Hazards may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• ground stability (e.g. ground condition, recently filled trenches and slopes)</li><li>• overhead hazards (e.g. powerlines and service pipes)</li><li>• insufficient lighting</li><li>• traffic (e.g. pedestrians, vehicles and other plant)</li><li>• fixed equipment, including machinery, tanks and conveyors</li><li>• environmental conditions (e.g. wind, lightning and storms)</li><li>• other specific hazards (e.g. dangerous materials)</li></ul>
<b>Hazard control measures</b>	<p>Hazard control measures refer to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <p>elimination substitution isolation engineering control measures using safe work practices personal protective equipment</p>
<b>Appropriate path</b>	<p>An appropriate path is one which:</p> <ul style="list-style-type: none"><li>• maximises safety and stability during lifting and transferring, including mobile operation of the crane and depositing of the load</li><li>• minimises disruption to other operations in the enterprise</li><li>• without compromising safety, stability and avoidance of disruption, is the most efficient route for the transfer of the load</li></ul>
<b>Appropriate standards</b>	<p>Appropriate standards may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• codes of practice</li><li>• legislation</li><li>• Australian standards</li><li>• manufacturer specifications</li><li>• enterprise and industry standards, where applicable</li></ul>
<b>Associated personnel</b>	<p>Associated personnel may include, but are not limited to:</p>

	<ul style="list-style-type: none"><li>• doggers</li><li>• riggers</li><li>• forklift and truck drivers</li><li>• production and trades employees</li></ul>
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<b>Environmental conditions</b>	<p>Environmental conditions may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• wind</li> <li>• lightning</li> <li>• storms</li> <li>• poor light</li> </ul>
<b>Crane</b>	<p>Crane may include:</p> <ul style="list-style-type: none"> <li>• a crane (greater than three tonnes capacity) which meets the requirements of AS 1418 Set-2009 Cranes, hoists and winches Set</li> <li>• articulated type mobile cranes</li> <li>• locomotive hauled and self-propelled rail cranes</li> </ul>
<b>Communication methods</b>	<p>Communication methods may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding</li> <li>• appropriate worksite protocol</li> </ul>
<b>Signage and labels</b>	<p>Signage and labels may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• crane data plates/labels</li> <li>• load charts</li> <li>• crane decals</li> <li>• control labels</li> </ul>
<b>Procedures</b>	<p>Procedures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• manufacturer guidelines (instructions, specifications, operators manual or checklists)</li> <li>• industry operating procedures</li> <li>• workplace procedures (work instructions, operating procedures and checklists)</li> </ul>
<b>Controls</b>	<p>Controls may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• luffing levers</li> <li>• hoisting and lowering levers</li> <li>• slewing levers, including brake</li> <li>• boom extension levers (where fitted)</li> </ul>
<b>Service logbook</b>	<p>Service logbook may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• any logbook</li> <li>• service book</li> <li>• history record system where the service and</li> </ul>



	maintenance history is kept
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<b>Crane safety devices</b>	<p>Crane safety devices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• horns/sirens</li> <li>• audible and visual reversing devices</li> <li>• operator restraint devices</li> <li>• lights</li> </ul>
<b>Communication equipment</b>	<p>Communication equipment may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• fixed channel two-way radios</li> <li>• whistles</li> <li>• bells</li> <li>• buzzers</li> </ul> <p>NB: Where radio communication equipment is used the transmitting frequencies of the equipment must be selected to prevent interference to or from other radio equipment being used in the vicinity of the crane</p>
<b>Ground suitability</b>	<p>Ground suitability may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• rough, uneven ground</li> <li>• backfilled ground</li> <li>• soft soils</li> <li>• hard, compacted soil</li> <li>• rock</li> <li>• bitumen</li> <li>• concrete</li> </ul>
<b>Stability</b>	<p>Stability may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• deploying outriggers</li> <li>• establishing correct size plates or packing</li> <li>• correctly positioning plates or packing</li> </ul>
<b>Crane configuration</b>	<p>Crane configuration includes set up of crane for:</p> <ul style="list-style-type: none"> <li>• lift and lowering of loads where crane is not required to move (e.g. where a load is lifted of a truck and the truck then moves away to allow load to be lowered)</li> <li>• mobile load transfer where load is lifted and transferred to a different location by the crane</li> </ul> <p>The configuration may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• boom/jib</li> <li>• fly-jib</li> <li>• counterweights</li> </ul>
<b>Hazard prevention/control measures</b>	<p>Hazard prevention/control measures may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated power lines</li> </ul>

	<ul style="list-style-type: none"><li>• safety observer used inside exclusion zone</li><li>• disconnected power</li><li>• traffic barricades and controls</li><li>• pedestrian controls</li><li>• trench covers</li><li>• movement of obstructions</li><li>• personal protective equipment</li><li>• adequate illumination</li></ul>
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<b>Test lift</b>	<p>Test list means the load is lifted just clear of the lifting plane to allow for checks to be safely made in consultation with associated personnel to ensure that:</p> <ul style="list-style-type: none"> <li>• near capacity loads do not overload the crane</li> <li>• loads of unusual shape or weight distribution are correctly slung</li> <li>• load measuring equipment can be used to verify the calculated weight of the load</li> <li>• all crane equipment is functioning properly</li> <li>• adjustments to the slinging can be made in a safe manner</li> </ul>
<b>Relevant crane movements</b>	<p>Relevant crane movements may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• telescope in and out</li> <li>• boom/jib up and down</li> <li>• articulating (as applicable)</li> <li>• raise and lower hoist (as applicable)</li> </ul>
<b>Communication signals</b>	<p>Communication signals may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• stop - hand</li> <li>• stop - whistle</li> <li>• hoist up - hand</li> <li>• hoist up - whistle</li> <li>• hoist down - hand</li> <li>• hoist down - whistle</li> <li>• luff boom down - hand</li> <li>• luff boom down - whistle</li> <li>• luff boom up - hand</li> <li>• luff boom up - whistle</li> <li>• telescope out - hand</li> <li>• telescope out - whistle</li> <li>• telescope in - hand</li> <li>• telescope in - whistle</li> <li>• slew/articulate right - hand</li> <li>• slew/articulate right - whistle</li> <li>• slew/articulate left - hand</li> <li>• slew/articulate left - whistle</li> </ul>
<b>Unplanned and/or unsafe situations</b>	<p>Unplanned and/or unsafe situations may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• failure/loss of control (e.g. brakes and steering)</li> <li>• failure of equipment (e.g. hydraulic system)</li> <li>• environmental conditions (e.g. wind, lightning and</li> </ul>

	storms)
<b>Planned route</b>	Planned route may include, but is not limited to: <ul style="list-style-type: none"><li>• unusual or difficult terrains</li><li>• obstacles or obstruction</li></ul>
<b>Best mobile practice</b>	Best mobile practice may include, but is not limited to: <ul style="list-style-type: none"><li>• minimum speed</li><li>• gentle acceleration and braking (to minimise load swing)</li><li>• minimum boom/jib length</li><li>• carrying the load near to the ground surface</li><li>• use of handheld taglines</li></ul>
<b>Shutdown</b>	Shutdown may include, but is not limited to: <ul style="list-style-type: none"><li>• retracting boom/jib/fly, where applicable</li><li>• retracting hoist rope and hook block</li><li>• idling engine to stabilise temperature</li><li>• retracting outriggers/stabilisers, where applicable</li><li>• turning off engine</li></ul>

## Unit Sector(s)

Materials handling

## Custom Content Section

Not applicable.

## MEM12001B Use comparison and basic measuring devices

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers sorting items using basic comparison measuring equipment, and maintaining the equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>Measurements are conducted in a production environment or at a work station.</p> <p>Work is undertaken autonomously or as part of teamwork. All comparative measurements are undertaken to standard operating procedures and to regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use comparison and/or basic measuring devices	<p>1.1.Measuring devices are identified and used to undertake required comparisons or measurements using standard operating procedures.</p> <p>1.2.Checking or sorting of items is undertaken using comparison and/or basic measuring device according to standard operating procedures.</p>
2. Maintain comparison and/or basic measuring devices	2.1.Basic care and storage is maintained to manufacturers' standards or standard operating procedures.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- using device in accordance with standard operating procedures
- storing and maintaining devices
- using basic numeracy skills for undertaking comparison measurements
- following oral instructions and written standard operating procedures

### Required knowledge

Look for evidence that confirms knowledge of:

- use and application of various comparison or measurement devices
- procedures for the correct use of devices
- procedures for maintaining and storing devices
- hazards and control measures associated with conducting measurements, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to use comparison and basic measuring devices.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment



**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using comparison and basic measuring devices or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Basic measuring devices</b>	<p>Linear measuring devices measuring to within 1mm graduation - may include rules, tapes and retractable tapes</p>
<b>Comparisons</b>	<p>Comparison of length, angle, size, temperature, pressure, weight, voltage, resistance and amperage</p>

**RANGE STATEMENT****Comparison measuring devices**

Go/no-go devices, thread angle and taper gauges, temperature gauges, pressure gauges, measuring gauges and overlay indicators, templates, digital devices and pre-set verniers and micrometers

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Measurement

## MEM12002B Perform electrical/electronic measurement

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting and using basic electro-measuring devices to check variables and the ability to maintain the devices.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the measurement of voltage, current, resistance, power, frequency etc. on a.c. and d.c. circuits up to 1000 volts, using appropriate measuring devices and for a range of general applications. Measurement skills for specific applications and context are covered by other units.</p> <p>For simple measurement tasks such as reading of fixed devices, testing continuity, and tasks requiring the use of devices mounted in measuring jigs etc. Unit MEM12023A (Perform engineering measurements) and/or Unit MEM12001B (Use comparison and basic measuring devices) should be considered.</p> <p>If electrical/electronic measuring devices require the connection or disconnection of circuitry, the appropriate units should also be selected.</p> <p>In circumstances where the application of this unit or where legislation dictates, relevant units covering first aid and/or emergency procedures should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use electro-measuring devices to measure variables	<p>1.1.Appropriate device or equipment and setting is selected to obtain required measurement.</p> <p>1.2.Appropriate connections are made to obtain required measurement according to standard operating procedure.</p> <p>1.3.Readings are obtained and interpreted correctly and conversion is made where necessary into the required units of measurement.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Maintain electro devices	2.1. Routine care and storage of devices is undertaken to manufacturer's specifications or standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting and using electro-measuring devices
- obtaining and interpreting specified electrical measurements
- selecting appropriate measuring devices
- performing arithmetic operations required to convert measurements into appropriate units of measurement
- maintaining and storing electro-measuring devices
- reading and interpreting information on standard operating procedures

#### Required knowledge

Look for evidence that confirms knowledge of:

- terminology and concepts relating to electrical/electronic measurement
- the selection of different measuring devices for particular applications within the scope of this unit
- specifications of selected electro-measuring devices
- the application of the settings on each electro-measuring device
- the procedures for obtaining electrical/electronic measurements
- procedures for connecting electro-measuring devices to circuitry
- the correct scale for each setting on the electro-measuring device
- the scale factor to be applied to readings taken from the electro-measuring device
- the units applying to electrical and electronic measurements
- maintenance and storage requirements for a range of electro-measuring devices
- that devices can impact on the circuit condition
- relevant State/Territory or Commonwealth legislative and regulatory requirements, industry standards, NOHSC guidelines and code of practice
- hazards and control measures associated with electrical/electronic measurement
- safe work practices and procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform electrical/electronic measurement.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with electrical/electronic measurement or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate

**EVIDENCE GUIDE**

	must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate device or equipment</b>	Analogue/digital multi meters, clip-on meter, oscilloscopes, potentiometers determined according to the type of measurement being taken
<b>Routine care</b>	Zero and linear adjustments, inspection, check for serviceability and safe operation

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Measurement
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## MEM12003B Perform precision mechanical measurement

### Modification History

Editorial correction to unit application to include missing notes relating to dual band status.

Single band identifier removed to clarify dual status.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing precision mechanical measurement by using precision measuring equipment, setting comparison measuring devices and maintaining precision equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to precision and/or complex use of strip gauges, engineering squares, lasers, angle dekkors, sine bars, angle gauges, polygons, dividing heads, rotary tables, precision levels, micrometers, height gauges, hardness testers, and texture measuring equipment etc.</p> <p>Work is undertaken autonomously or as part of team environment. Work is undertaken in the field (in situ) or in a workshop/laboratory environment.</p> <p>This unit covers comprehensive measuring skills where judgement is required in the selection of the most appropriate techniques/devices and where results are interpreted/analysed.</p> <p>All specifications are obtained from engineering drawings and data sheets and/or manufacturers' instructions/data.</p> <p>All measurement/test procedures are undertaken to standard operating procedures or manufacturers' recommended procedures.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation Band A unit and Specialisation Band B unit for progression to C7 (AQF level IV)</p>
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	<b>Unit Weight: 2</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use precision measurement equipment	1.1.Appropriate precision equipment is selected to achieve specified outcome. 1.2.Correct and appropriate measuring techniques are

ELEMENT	PERFORMANCE CRITERIA
	<p>used for the measurement task.</p> <p>1.3. Measurements are taken accurately to the finest graduation of instrument.</p> <p>1.4. Readings and measurements are interpreted correctly and accurately.</p>
2. Set comparative measuring devices	2.1. Measuring equipment is set to specifications using manufacturer guidelines or standard operating procedures and techniques.
3. Maintain precision equipment	<p>3.1. Measuring equipment is adjusted and maintained to required accuracy, using manufacturer or standard operating procedures and techniques.</p> <p>3.2. Equipment is stored to manufacturer specifications or standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting text and numerical information on manufacturer specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- selecting/using precision mechanical measuring devices
- setting measuring devices to specification
- obtaining specified mechanical measurements to the finest graduation of the device
- measuring components to specified tolerances
- reading and interpreting measurements
- maintaining and adjusting precision mechanical measuring devices
- storing precision mechanical measuring devices
- undertaking calculations and numerical operations for measurement using precision mechanical measuring equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- the appropriate precision mechanical measuring device for given measurement

**REQUIRED SKILLS AND KNOWLEDGE**

requirements

- procedures to verify equipment being used has been recently calibrated
- suitability of environmental conditions for the measurements being carried out
- procedures/techniques for obtaining a range of mechanical measurements
- the accuracy to which a range of precision mechanical measuring devices can be read
- procedures for reading graduated mechanical measuring devices
- units of measurement and numerical operations within the scope of this unit
- procedures for setting precision mechanical measuring devices
- specifications of the equipment to be set
- tools and equipment for setting mechanical measuring devices
- the adjustments that can be made to a range of precision mechanical measuring devices
- procedures for adjusting and maintaining precision mechanical measuring devices
- procedures for storing precision mechanical measuring devices
- hazards and control measures associated with precision mechanical measurement, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform precision mechanical measurement. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where

<b>EVIDENCE GUIDE</b>	
	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with other units addressing the safety, quality, communication, materials handling, recording and reporting associated with precision mechanical measurement or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Equipment</b>	Strip gauges, engineering squares, angle dekkors,

<b>RANGE STATEMENT</b>	
	sine bars, angle gauges, polygons, dividing heads, rotary tables, precision levels, micrometers, height gauges, hardness testers, and texture measuring equipment
<b>Appropriate measuring techniques</b>	Includes considerations of the suitability of the environmental conditions for measurements being taken
<b>Measurements</b>	Length, circular, straightness, flatness, hardness, angles, finishes, textures, roundness, squareness, alignment and coordinate measurement etc. on components or equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Measurement
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## MEM12004B Perform precision electrical/electronic measurement

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using precision measuring equipment, setting measuring devices and maintaining precision equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the identification of measuring requirements, the selection of appropriate measuring devices and calibration and care of devices to obtain accurate, precision measurements.</p> <p>Measurement includes range of frequencies and may be undertaken on the full range of electrical /electronic equipment including a.c., d.c., analog and digital equipment, microwave.</p> <p>Work is undertaken onsite and/or workshop/laboratory environment.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Use equipment for precision measurement	1.1.Specifications are interpreted accurately from drawings, instructions. 1.2.Appropriate equipment is selected to achieve specified outcome. 1.3.Correct and appropriate measuring techniques are used. 1.4.Readings and measurements are interpreted correctly and accurately.
2. Set measuring devices	2.1.Equipment is set up to specifications utilising manufacturers' or standard operating techniques.
3. Maintain precision	3.1.Measuring equipment is adjusted and maintained to required accuracy, utilising manufacturers'



ELEMENT	PERFORMANCE CRITERIA
equipment	specifications or standard operating techniques. 3.2.Care and storage of equipment is undertaken to manufacturers' specifications or standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting drawings, specifications, data sheets and instructions
- taking measurements using precision electrical/ electronic measuring devices
- interpreting measurements for a range of precision electrical/electronic measuring devices
- setting and adjusting precision electrical/electronic measuring devices
- maintaining and storing precision electrical/electronic measuring devices

#### Required knowledge

Look for evidence that confirms knowledge of:

- specifications of the circuitry and/or components to be tested
- application of a range of precision electrical/electronic measuring devices
- procedures/techniques for obtaining a range of electrical/electronic measurements
- units of measurement used in conjunction with precision electrical/electronic measurement
- procedures for setting a range of precision electrical/electronic measuring devices
- specifications of the equipment to be set
- tools and equipment to be used in setting precision electrical/electronic measuring devices
- adjustments that can be made to a range of precision electrical/electronic measuring devices
- procedures for adjusting and maintaining a range of precision electrical/electronic measuring devices
- procedures for storing precision electrical/electronic measuring devices
- specifications of precision electrical/electronic measuring devices

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform precision electrical/electronic measurement.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with precision electrical/electronic measurement or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

<b>EVIDENCE GUIDE</b>	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Equipment for precision measurement</b>	Analog and digital meters, cathode ray oscilloscopes, bridges and potentiometers, wattmeters and digital probes etc.
<b>Measurement</b>	Peak and transient voltages, transient frequencies, digital wave form analysis etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Measurement
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## MEM12005B Calibrate measuring equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking measuring equipment for correct operation, and validating/calibrating precision measuring equipment in accordance with predetermined procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the calibration skills used in the setting, adjustment, validation or verification of precision mechanical and/or electrical/electronic measuring instruments using reference standards in accordance with predetermined standard procedures. This may involve the use of electronic setting equipment and the selection or determination of an appropriate external standard in accordance with standard operating procedures.</p> <p>This unit is not meant to apply to simple zeroing, external adjustment or manual adjustment for size range e.g. micrometers etc; these skills are covered by Unit MEM12023A (Perform engineering measurements), Unit MEM12003B (Perform precision mechanical measurement) or Unit MEM12004B (Perform precision electrical/electronic measurement) as appropriate.</p> <p>There may be occasions when both pathways MEM12003B and MEM12002B will be required.</p> <p>Where additional electrical/electronic measurement skills are required, then Unit MEM12004B (Perform precision electrical/electronic measurement) should be considered.</p> <p>Competence in this unit does not require the level of skill that applies to calibration as defined in ISO 9000 and/or carried out by personnel accredited under ISO/IEC 17025/NATA certification or similar.</p> <p>Unit MEM15010B (Perform laboratory procedures) should be considered for this level of calibration.</p>
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	<p>Where reference standards only are to be verified under laboratory conditions, then MEM15022B (Verify reference standards) should be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
<b>Path 2</b>	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check equipment for correct operation	1.1.Appropriate checks are made of components, leads, fasteners, etc. for wear, loose connections or other faults.
2. Validate/calibrate precision measuring equipment	2.1.Calibration of precision measuring equipment is assessed to manufacturers' specifications and/or standard operating procedures. 2.2.Equipment is calibrated against appropriate physical standards using correct calibration devices, equipment, techniques using predetermined procedures. 2.3.Equipment is recommissioned in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting work requirements
- using appropriate tools and equipment to check measuring equipment for faults
- using appropriate techniques to check the calibration of the measuring equipment for conformance to specifications
- calibrating the measuring equipment against the appropriate physical standard
- recommissioning the measuring equipment
- using literacy and numeracy skills to enable correct completion of calibration records

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- measuring equipment specifications, operation, wearing parts, connections and components
- checks that are to be made of the measuring equipment and the tools and equipment to be used when checking the measuring equipment
- common fault(s) that may be found in the measuring equipment
- effects of faults on the performance/accuracy of the measuring equipment
- general knowledge of standards, legislative or regulatory requirements applicable to the measuring equipment and/or its calibration
- standard operating procedures for calibrating the measuring equipment and the tools and equipment required to do so
- standard operating procedures for commissioning the measuring equipment
- calibration records to be kept/maintained in accordance with standard operating procedures
- hazards and controls associated with calibrating measuring equipment

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to check equipment for correct operation and validate/calibrate precision measuring equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must



<b>EVIDENCE GUIDE</b>	
	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with calibrating measuring equipment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Calibration</b>	To standardise the quantities of a measuring instrument

<b>RANGE STATEMENT</b>	
<b>Physical standards</b>	Reference standards of mass length, time, temperature, pressure, volume, process characteristics etc.
<b>Calibration devices, equipment</b>	Micrometer, vernier caliper, voltmeter, oscilloscope, all types of comparators, jigs and fixtures, templates and patterns etc.
<b>Techniques</b>	In standard operating procedures, manufacturers' manuals
<b>Recommissioned</b>	Sealing, tagging, identification or storage in accordance with standard operating procedures

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Measurement
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## MEM12006C Mark off/out (general engineering)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers marking off/out by transferring dimensions from engineering drawings, prints or plans to engineering items that are to be either manufactured or set up. Dimensions may be directly transferred or may require calculation from information on the drawings, prints or plans.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to marking off/out techniques used for the transfer of dimensions from engineering drawings, prints or plans to items that are to be set up or manufactured, for example, engineering components, jigs and fixtures, castings, templates, dies and tooling.</p> <p>This unit has been developed for Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in mark off/out in general engineering. Skills covered by this unit are generally applied in occupational and work situations associated with trade level fitting, machining and toolmaking work.</p> <p>Marking off/out is undertaken using appropriate tools and equipment and templates are produced as required. Marking off/out techniques may apply to a range of materials and shapes.</p> <p>The task may be performed in a workshop or in situ.</p> <p>This unit is not intended to cover the skills used in a simple transfer of a dimension or marking a location point associated with general engineering and maintenance functions. For these skills refer to MEM07005C Perform general machining, MEM18006C Repair and fit engineering components or MEM18014B Manufacture</p>
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	<p>press tools and gauges.</p> <p>Where a higher level of calculation, measurement or precision work is required, see MEM30012A Use mathematical techniques and perform simple statistical computations, MEM12003B Perform precision mechanical measurement or MEM18003C Use tools for precision work, respectively.</p> <p>For marking out structural fabrications and shapes, refer to MEM12007D Mark off/out structural fabrications and shapes.</p> <p>This unit covers the marking out skills only. When the manufacture of templates is required, other appropriate units may need to be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings, job instructions and specifications are interpreted and understood 1.2. Appropriate methods and sequencing are selected consistent with proposed manufacturing process using standard operating procedures
2. Transfer dimension	2.1. All marking off/out is carried out to specifications using appropriate tools and equipment 2.2. Datum points are correctly established 2.3. Dimensions are transferred and correct and appropriate calculations are used where required

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- determining job requirements
- transferring dimensions
- applying method and sequence of marking out
- making templates as required
- establishing datum points
- reading and interpreting routine information on written job instructions, specifications standard operating procedures and engineering drawings

**REQUIRED SKILLS AND KNOWLEDGE**

- performing calculations using formulae
- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- checking and clarifying strategies

**Required knowledge**

Required knowledge includes:

- drawings, job instructions and specifications
- procedures for marking off/out
- tools, equipment and techniques related to the task
- purpose of establishing datum points
- method of determining/calculating dimensions
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to mark off/out in a general engineering situation. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:

- examination of detailed drawings for marking out requirements and specifications including materials, measurements and tolerances, manufacturing methods, standards and code requirements
- correct calculation of measurements not shown on

**EVIDENCE GUIDE**

	<p>drawings</p> <ul style="list-style-type: none"> <li>• sequence of measuring and/or development is determined correctly</li> <li>• correctly establishing and marking datum points</li> <li>• measurements are accurately transferred to component, jig, fixture, casting, template, die or tooling</li> <li>• accurate production of templates.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency in marking off/out general engineering items as applied to trade level fitting, machining and toolmaking work environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Mechanical work are required to apply their geometric development skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

**EVIDENCE GUIDE****Guidance information for assessment**

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with marking off/out general engineering items or other units requiring the exercise of the skills and knowledge covered by this unit.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Marking off/out**

Marking off/out may include engineering components, jigs and fixtures, castings, templates, dies and tooling

**Tools and equipment**

Tools and equipment may include:

- marking out tables
- surface tables
- rotary tables
- dividing heads
- vee blocks
- cylinder squares
- sine bars
- vernier height gauges
- protractors
- straight edge and set squares
- hammers
- scribes



**RANGE STATEMENT**

	<ul style="list-style-type: none"><li>• centre punch</li><li>• marking medium</li></ul>
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Measurement
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## MEM12007D Mark off/out structural fabrications and shapes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills required by an Engineering Tradesperson - Fabrication for transferring the dimensions from the detail drawing to work, making templates as required, developing patterns and/or transferring measurements to structures, interpreting relevant codes, standards and symbols and estimating quantities of material from drawings.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit of competency applies to the marking off/out of general fabrications and shapes using appropriate tools and equipment. The marking out is undertaken to specified measurements, tolerances and shapes.</p> <p>Skills covered by this unit are generally applied in occupational and work situations associated with steel fabrication, boilermaking or sheet metal work.</p> <p>This unit has been developed for Engineering Tradesperson - Fabrication apprenticeship training and the recognition of trade level skills in mark off/out of structural fabrications and shapes.</p> <p>All work and work practices are carried out to industry, regulatory and legislative requirements. The task may be performed in the workshop or in situ.</p> <p>Templates and patterns are produced as required.</p> <p>In a marine setting, it includes basic lofting/set out for construction of marine vessels and may include items such as stem and transom development and use of tables of offsets that reflect chine and hull configuration. This may include lofting surfaces, straight edges, string lines, French curves, templates, etc. Marking out techniques may apply to a range of materials and shapes.</p>
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	<p>Where more extensive lofting practices are used, MEM09021B Interpret and produce curved 3-dimensional shapes should be considered.</p> <p>For marking out general engineering components, refer to MEM12006C Mark off/out (general engineering).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Transfer dimensions from a detail drawing to work or surface	1.1.Specifications and work requirements are determined and understood using correct and appropriate calculations 1.2.Marking out is carried out to specifications or standard operating procedures using appropriate tools and equipment 1.3.Datum points are established
2. Make templates/patterns as required	2.1.Appropriate template/pattern material is chosen when required 2.2.Required templates are produced to specifications 2.3.Correct storage procedures are followed including labelling and identification to standard operating procedures
3. Develop patterns and/or transfer measurements to structures	3.1.Most appropriate development and/or measurement sequence is chosen and applied 3.2.Allowances for fabrication and assembly are correctly determined and transferred 3.3.Measurement transfer/layout of components is checked to ensure accuracy/set out
4. Interpret relevant codes, standards and symbols	4.1.Relevant standards/codes and symbols are interpreted 4.2.Requirements of standards/codes are interpreted and applied to materials and processes
5. Estimate quantities of materials from detail drawings	5.1.Materials are correctly identified 5.2.Quantities are estimated from drawing 5.3.Material wastage is minimised

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Required skills include:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- planning and sequencing operations
- using techniques and equipment required for marking off/out and developing patterns
- checking for conformance to specifications
- establishing and marking datum points
- developing patterns according to specification
- determining fabrication and assembly allowances and transferring to the pattern
- where applicable, applying the requirements of the codes/standards during the geometric development/marketing off/out process
- determining material and component quantities from drawings and job specifications
- minimising material wastage

**Required knowledge**

Required knowledge includes:

- procedures for marking off/out and pattern development
- tools and equipment to be used in the preparation of the marking off/out
- datum points
- materials that can be used for the preparation of templates and their application
- manufacturing allowances that have to be considered when developing patterns
- template labelling and identification procedures
- storage requirements of templates
- appropriate methods of development/marketing off/out of a range of given objects
- appropriate fabrication and assembly allowances
- effects of material type and thickness on fabrication and assembly allowances
- sources of data on fabrication and assembly allowances
- relevant standards and codes and the meaning of symbols used
- requirements of the codes/standards applicable to the work to be done
- materials from which the component/assembly is to be manufactured
- benefits of minimising material wastage
- applicable industry standards, national/Australian Standards, NOHSC guides, state/territory regulatory codes of practice/standards
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to mark off/out structural fabrications and shapes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different workplace situations and contexts. Critical aspects of assessment and evidence include:

- examining detailed drawings for fabrication requirements and specifications including materials, measurements and tolerances, joining methods, standards and code requirements
- correctly determining sequence of measuring and/or development
- correctly establishing and marking datum points
- accurately transferring measurements to components
- correctly calculating allowances for fabrication and assembly including shrinkage, thickness and inside/outside measurements
- accurately producing templates.

#### Context of and specific resources for assessment

This unit has been developed to support training in and recognition of trade level competency in marking off/out structural fabrications and shapes as applied to a sheet metal or metal fabrication environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.

The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

**EVIDENCE GUIDE****Method of assessment**

Typically, persons engaged in Engineering Tradesperson - Fabrication work are required to apply their geometric development skills and techniques across a range of jobs and specifications.

A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with marking off/out structural fabrications and shapes or other units requiring the exercise of the skills and knowledge covered by this unit.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Range Statement****RANGE STATEMENT**

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Equipment</b>	Equipment may include marking out tools as required
<b>Template material</b>	Template material may include: <ul style="list-style-type: none"> <li>• steel plate</li> <li>• perspex</li> <li>• timber</li> <li>• cardboard</li> <li>• paper</li> </ul>
<b>Storage procedures</b>	Storage procedures may include: <ul style="list-style-type: none"> <li>• labelling</li> <li>• identification (e.g. template lofts)</li> </ul>
<b>Allowances</b>	Allowances may include: <ul style="list-style-type: none"> <li>• thickness</li> <li>• bend</li> <li>• pitch</li> <li>• angle</li> <li>• circumference</li> <li>• perimeter</li> </ul>
<b>Standards/codes and symbols</b>	All work carried out in accordance with legislative and regulatory requirements

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Measurement
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## MEM12019B Measure components using coordinate measuring machines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating coordinate measuring machines (CMM) in a production environment. The unit also covers basic setting up of components and manually aligning probes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies where the operator is following established processes, practices and standard operating procedures and is responsible for providing dimensional detail required for adjustment or checking of the manufacturing process.</p> <p>Work is carried out autonomously using predetermined standards of quality and safety. Operators would be expected to have competence in basic setting and adjusting of machines.</p> <p>An appropriate level of measurement skill should be selected with this unit.</p> <p>Where it is required to use tools, then unit MEM08001B (Use hand tools) should also be selected.</p> <p>Where basic operation excludes setting up components and manually aligning probes, Unit MEM07024B (Operate and monitor machine/process) should be selected.</p> <p>Where other machines/processes are to be adjusted as a consequence of the CMM operation, appropriate machining/process operation units should also be selected.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirements	1.1. Job sheets or equivalent instructions are interpreted correctly.

ELEMENT	PERFORMANCE CRITERIA
2. Load components	<p>2.1.Pre-start checks are undertaken to standard operating procedures.</p> <p>2.2.Correct safety procedures are observed and safety equipment is checked for correct operation.</p> <p>2.3.Correct fixture/clamping device is selected.</p> <p>2.4.Component and fixtures are loaded and clamped in accordance with standard operating procedures.</p>
3. Set probes	<p>3.1.Probe configuration is checked in accordance with standard operating procedures.</p> <p>3.2.Pre-measurement manual hits are taken for manual alignment in accordance with standard operating procedures.</p>
4. Measure components	<p>4.1.Part program is selected as required, run and verified according to standard operating procedures.</p> <p>4.2.Components are measured according to standard operating procedures.</p> <p>4.3.Results are interpreted and non-conforming/out of tolerance measurements are identified and reported.</p> <p>4.4.Part program is correctly shut down and components are removed according to standard operating procedures.</p> <p>4.5.Coordinate measuring machine, accessories and surrounds are left in a clean, safe condition.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following routine, familiar information for loading, setting probes and measuring components
- identifying and following pre-start check procedure
- following safety procedures
- selecting specified fixture/clamping device
- positioning and clamping components

**REQUIRED SKILLS AND KNOWLEDGE**

- taking manual hits and determining probe alignment
- verifying probe/s configuration to specifications
- selecting and activating part programs as required where machine is fitted with microprocessors
- verifying and confirming correct program operation
- applying correct measuring techniques
- reporting out of tolerance measurements
- shutting down the part program
- removing and handling components
- cleaning machine and site
- following verbal instructions
- orally reporting routine information

**Required knowledge**

Look for evidence that confirms knowledge of:

- task-related information on job sheets or equivalent
- pre-start checks
- hazards and control measures associated with operating a CMM, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures
- fixtures/clamping devices and their uses
- storage location and procedures
- fixing/clamping methods
- procedures for undertaking pre-measurement manual hits for manual alignment
- procedures for checking probe configuration
- procedures for running and verifying part program
- methods/techniques for interpreting results
- procedures for reporting results and recommendations for adjustment
- procedures for shutting down part program
- procedures to safely remove and handle components
- required cleaning tasks and the importance of cleaning the CMM
- effects of contamination

**Evidence Guide****EVIDENCE GUIDE**

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to measure components using a coordinate measuring machine in accordance with instructions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with measuring components using a coordinate measuring machine or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Probe</b>	Solid or electronic trigger probes
<b>Measurements</b>	Are limited to those which can be measured directly and do not require to be constructed mathematically
<b>Coordinate measurement machine</b>	Manual machines and machines fitted with microprocessors

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Measurement
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## MEM12020B Set and operate coordinate measuring machines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting and operating coordinate measuring machines (CMM). It includes setting up/orienting components, selecting and activating part programs, preparing the machine, editing programs and measuring components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of coordinate measuring machines (CMM). Measurement procedure is determined according to established processes, practices, and specifications. Work is carried out autonomously using predetermined standards of quality and safety. The procedures apply to both one-off and multiple components.</p> <p>Appropriate levels of measurement, computer operations and drawing skills should be selected with this unit. Where a range of hand tools is required, Unit MEM08001B (Use hand tools) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify job requirements	<p>1.1.The measurement to be made is determined from instructions/plans and relevant job specifications.</p> <p>1.2.Drawing information is interpreted correctly, datums established and the range of tolerances applying to components is understood.</p>
2. Set up/orient components	<p>2.1.Pre-start checks are undertaken to standard operating procedures.</p> <p>2.2.Correct safety procedures are observed and all equipment is checked for safe operation.</p> <p>2.3.The most appropriate method of clamping/support is determined to minimise distortion and maximise measuring access.</p>

ELEMENT	PERFORMANCE CRITERIA
	2.4.Component/fixture/clamping devices are correctly set up and oriented.
3. Select and activate part programs	3.1.Part program is identified according to standard operating procedures as required. 3.2.Part program is verified. 3.3.Selected part program is activated according to standard operating procedures.
4. Prepare CMM	4.1.Probe configuration is determined according to specifications. 4.2.Probe configuration is adjusted on coordinate measuring machine according to standard operating procedures. 4.3.Probe angles are checked for compliance and adjusted as required. 4.4.CMM is re-set/re-calibrated. 4.5.Probes are manually aligned for one-off components.
5. Edit part programs	5.1.Part program is edited to compensate for errors or changes to component specifications.
6. Measure components	6.1.Components are measured and checked for conformance to specification. 6.2.Data/report is produced

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job sheets, instructions, standard operating procedures and drawings
- checking and clarifying task-related information
- entering information onto workplace documents
- checking for conformance to specifications
- measuring components to specified tolerances
- using methods of coordinate measurement

**REQUIRED SKILLS AND KNOWLEDGE**

- positioning and securing components effectively
- selecting and running part programs
- loading configuring and adjusting probes
- checking and adjusting probe angles
- re-setting/re-calibrating the CMM
- taking manual hits
- identifying problems/errors in program
- editing program to ensure accurate operation
- checking results against drawings/specifications and interpreting for non-conformance

**Required knowledge**

Look for evidence that confirms knowledge of:

- principles and methods of coordinate measurement
- principles and interpretation of geometric tolerancing
- task-related information, symbols and terminology
- pre-start checks
- types and functions of various fixtures/clamping devices
- principles and methods of clamping
- efficient set-up/orientation procedure
- procedures to locate and activate part program
- procedures to verify changes/upgrades to part programs
- various probes and their uses and configurations
- setting and adjusting probes
- requirements and procedures for re-setting/re-calibrating the CMM
- procedure and reason for taking manual hits
- procedures for editing part programs
- procedure for interpreting results
- the procedure for maintaining records
- reporting procedures
- hazards and control measures associated with setting up and operating coordinate measuring machines, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures
- techniques, tools and equipment to measure components

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to set and operate a coordinate measuring machine.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting and operating coordinate measuring machines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for</b>	

**EVIDENCE GUIDE**

assessment

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Measurement**

Includes those which can be measured directly and those that require to be constructed mathematically

**Probe**

May include solid or electronic trigger probes

**Coordinate measuring machine**

Manual and machines fitted with microprocessors. Machines may also include horizontal, vertical and gantry tie machines

**Unit Sector(s)**

Unit sector

**Co-requisite units**

Co-requisite units

## Competency field

Competency field	Measurement
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## MEM12021B Program coordinate measuring machines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing, trialling and editing basic programs for coordinate measuring machines to measure features of a part in a single work plane using a single probe.
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### Application of the Unit

<b>Application of the unit</b>	<p>The skills in this unit extend to writing basic programs to measure features of a part in a single work plane using a single probe. The program produced may be used on a range of coordinate measuring machines and would be suitably archived and backed up. Programs are trialled and edited as necessary. Work would be undertaken autonomously using predetermined standards of quality.</p> <p>For programming using multiple probes and more than one plane, Unit MEM12022B (Program coordinate measuring machine [advanced]) should be selected. Appropriate levels of measuring, computer and engineering drawing skills should be selected with this unit.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify part program parameters	1.1. Job specifications and requirements are correctly established. 1.2. Appropriate units are selected to comply with specifications. 1.3. Part program name is specified according to standard operating procedures.
2. Establish single probe configurations	2.1. Single probe configuration is determined according to standard operating procedures. 2.2. Probe angles are determined and qualified in

ELEMENT	PERFORMANCE CRITERIA
	accordance with standard operating procedures.
3. Position/align component	3.1.Component/part is positioned and oriented correctly. 3.2.Manual alignment is created according to standard operating procedures. 3.3.Single Direct Computer Control (DCC) alignment is created according to standard operating procedures.
4. Measure features	4.1.Features are measured correctly. 4.2.Probe movement parameters are defined in accordance with standard operating procedures. 4.3.Basic features are dimensioned according to specifications. 4.4.Operator notes are reported. 4.5.Dimension descriptions are inserted.
5. Verify and back up the program	5.1.Execution and accuracy of program is verified according to standard operating procedures. 5.2.Program is edited, if required. 5.3.Results are output to various formats according to standard operating procedures. 5.4.Program is archived and backed up.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- using methods of coordinate measurement
- analysing and establishing part program parameters
- checking and clarifying information
- entering information onto proformas and standard workplace forms
- navigating and entering data in applicable program software
- checking for conformance to specifications
- using precision measurement equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- measuring components to specified tolerances
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- following verbal instructions
- orally reporting routine information
- selecting the correct units for the part program
- identifying the part program in accordance with current identification/quality system
- determining the probe configuration
- calculating/determining and qualifying probe angles
- positioning/aligning/securing component/part to appropriate orientation on CMM table and complying with probe configuration and calibrated angles
- taking an appropriate number of hits to create an accurate manual alignment
- demonstrating the correct procedure for creating DCC alignment
- measuring the part features in the correct sequence and location in a single work plane
- defining and verifying the parameters
- correctly dimensioning basic feature such as circles, points etc.
- producing and inserting explanatory notes for the operator
- inserting all necessary dimension descriptions
- running the part program and verifying the accuracy of the results
- editing, where non-conformance is identified
- outputting results to printer, disc or other format as required
- archiving and backing up part program

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles and methods of coordinate measurement
- principles and interpretation of geometric tolerancing
- the procedure for producing the part program
- the specifications for the program
- the criteria for selecting specific units
- the procedures and parameters for naming programs
- the procedure for determining probe configuration
- the reasons for selecting single probe configuration
- the procedure for determining/calculating probe angles
- the correct procedure and parameters for qualification
- the reasons for the specific location and aligning/securing the component/part
- the method of securing/clamping
- the methodology used to create manual alignment for the part
- the procedure and reasons for creating a single DCC (Direct Computer Control )

## REQUIRED SKILLS AND KNOWLEDGE

- alignment
- the criteria for defining probe movement
- the procedure for verifying correct probe movement
- dimensioning techniques
- the procedure for running the program
- the procedure for verifying the results
- editing process and explanations
- the procedures used to output results to various formats
- the method used to archive and back up the program
- access limitations by personnel and quality control guidelines
- hazards and control measures associated with using CMMs, including housekeeping
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to program a coordinate measuring machine. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with programming coordinate measuring machines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Measurement
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## MEM12022B Program coordinate measuring machines (advanced)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing, trialling and editing programs for coordinate measuring machines to measure features of parts in multiple planes using multiple probes.
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### Application of the Unit

<b>Application of the unit</b>	<p>The skills in this unit extend to writing programs to measure features of parts in multiple planes using multiple probes. The program produced may be used on a range of coordinate measuring machines and would be suitably archived and backed up. Programs are trialled and edited as necessary. Work would be undertaken autonomously using predetermined standards of quality.</p> <p>For programming using single probes in a single plane, Unit MEM12021B (Program coordinate measuring machines) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine program requirements	1.1.Part parameters and measurement requirements are determined. 1.2.Program attributes are established according to standard operating procedures.
2. Determine probe configuration for multiple probes	2.1.Probe configuration is determined according to standard operating procedures. 2.2.Probe angles are determined and multiple probes are qualified.
3. Create multiple Direct	3.1.Multiple DCC alignment is created according to



ELEMENT	PERFORMANCE CRITERIA
Computer Control (DCC) alignment	standard operating procedures. 3.2.DCC sub-routines are integrated.
4. Construct advanced geometric features	4.1.Geometric features are determined and constructed. 4.2.Features are dimensioned according to standard operating procedures.
5. Review and maintain part programs/system	5.1.Part programs are reviewed/edited to comply with changes to specifications. 5.2.System wide options are changed. 5.3.Programs are archived and backed up according to standard operating procedures. 5.4.Results are output to various formats according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining program parameters from written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- selecting the correct units for the job requirements
- selecting suitable probes and determining probe configuration
- determining and qualifying probe angles for each probe
- creating multiple DCC alignment
- integrating new and/or existing DCC sub-routines
- constructing geometric features for the program
- reviewing and editing program to specification
- changing system wide operations to ensure the most efficient operation of the program
- checking that the integrity of the system is maintained
- archiving and backing up
- outputting results output to printer, disc or other formats
- planning and sequencing operations/processes
- checking and clarifying information

## REQUIRED SKILLS AND KNOWLEDGE

- completing workplace documents and short reports
- checking for conformance to specifications
- undertaking calculations for determining program parameters and checking tolerances
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- following verbal instructions
- orally reporting information

## Required knowledge

Look for evidence that confirms knowledge of:

- program specifications
- the procedure for producing the program
- the parameters for selecting attributes
- the reason for selecting multiple probes
- the procedure for determining multiple probe configuration
- the procedure for determining probe angles
- the qualification procedure
- the procedure for creating DCC alignment
- the critical differences between single and multiple DCC alignment
- problems due to integrating sub-routines
- advantages gained through integration of DCC sub-routines
- the procedure for constructing geometric features
- reasons for constructing features in the sequence followed
- the procedure for ensuring the dimensioning techniques comply with relevant standards
- the procedure for ensuring all notes/instructions are clear and logical
- the procedures and parameters for editing, archiving and backing up programs
- the effects of editing particular sections of the program
- the effects on other programs of changing software or hardware options
- the procedures for changing system-wide options
- the list of recipients or those with access rights to the programs
- the procedures for producing/storing results/reports
- the procedure for notifying personnel of completion of the program is explained
- techniques, tools and equipment to measure components
- hazards and control measures associated with advanced CMM programming, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform advanced programming of a coordinate measuring machine. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced programming of a coordinate measuring machine or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any

<b>EVIDENCE GUIDE</b>	
	relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Measurement
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## MEM12023A Perform engineering measurements

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing measurement skills requiring straightforward use of mechanical measuring devices and associated calculations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers straightforward measurement using devices which incorporate visual indications representing units of measurement.</p> <p>It applies to the use of measuring devices in a range of manufacturing, engineering and related environments. It includes, where required, adjustment of measuring devices through simple means and typically includes zeroing or scale adjustment.</p> <p>Measurements may be expressed in metric or imperial units. All measurements are undertaken to standard operating procedures. Electrical/electronic devices used are those not requiring the connection or disconnection of circuitry.</p> <p>Work is undertaken autonomously or part of team environment, in the field, work station or workshops.</p> <p>For straightforward use of comparison or pre-set measuring devices, Unit MEM12001B (Use comparison and basic measuring devices) should be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 5</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select appropriate device or equipment	1.1.Measurement requirements are determined from specifications. 1.2.Appropriate device or equipment is selected according to standard operating procedures, to achieve required outcome.
2. Obtain measurements using a range of measuring devices	2.1.Correct and appropriate measuring technique is used. 2.2.Measurements are accurately obtained .

ELEMENT	PERFORMANCE CRITERIA
	2.3. Dimensions are determined or verified using basic calculations, where required.
3. Maintain measuring devices	3.1. Routine care and storage of devices is undertaken to manufacturers' specifications or standard operating procedures. 3.2. Routine adjustments to devices are made and checked.
4. Communicate measurements as required	4.1. Measurements are accurately recorded, where required. 4.2. Freehand sketch which depicts required information is prepared, as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting the appropriate measuring device for given measuring tasks
- using appropriate measuring technique
- reading all measurements taken accurately to the finest graduation of the selected measuring device
- handling and storing measuring devices in accordance with manufacturers' specifications or standard operating procedures
- verifying all measuring devices before use
- making, where appropriate, routine adjustments to measuring devices
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations involving addition, subtraction, multiplication, division, fractions and decimals within the scope of this unit
- preparing drawings as required



## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- correct application of a range of measuring devices
- correct and appropriate measuring technique for a range of measuring devices
- addition, subtraction, multiplication, division, fractions, decimals to the scope required by this unit
- procedures for handling and storing a range of measuring devices
- procedures for adjusting and zeroing a range of measuring devices
- methods of communicating measurements by drawings, as required
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform engineering measurements.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with performing engineering measurements or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Specifications</b>	Drawings, sketches, job instructions, schematics, diagrams, technical manuals
<b>Range of measuring devices</b>	Protractors, combination squares, set squares, dial indicators, thermometers, tapes, rules, micrometers, vernier-scaled measuring equipment
<b>Basic calculations</b>	Calculations needed to assist in determining measurements where a reading of the graduated device is not sufficient, for example subtracting one measurement from another to give a third

<b>RANGE STATEMENT</b>	
	measurement. Examples of calculations needed are addition, subtraction, multiplication, division, fractions and decimals. Calculations may be made using a calculator
<b>Routine adjustments</b>	Validating the device using simple zeroing or scale adjustment
<b>Measurements</b>	Measuring length, squareness, flatness, angle, roundness, clearances or any other measurements that can be read off analog, digital or other measuring device
<b>Information</b>	Dimensions, instructions, base line or datum points

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Measurement
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## MEM12024A Perform computations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers estimating approximate answers to arithmetical problems, carrying out basic calculations involving percentages and proportions, and determining simple ratios and averages. The unit includes producing and interpreting simple charts and graphs.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in manufacturing, engineering or related environments. It includes the application of the four rules of algebraic expressions, extracting information from drawings, diagrams, graphs and charts and producing simple charts and graphs.</p> <p>Data may be derived from readings taken or may be computer generated. Applications can include computations associated with pressure, volume, temperature, heat, speed, power, elasticity, density, mass, force etc.</p> <p>Calculations may be performed using pen and paper or on a calculator.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 3</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine work requirement	1.1.Required outcomes are established from job instructions. 1.2.Data is obtained from relevant sources and interpreted correctly. 1.3.Required calculation method is determined to suit the application, including selection of relevant arithmetic operations and/or formulae. 1.4.Expected results are estimated, including rounding off, as appropriate.
2. Perform calculations	2.1.Calculation method is applied correctly. 2.2.Correct answer is obtained. 2.3.Answer is checked against estimation.

ELEMENT	PERFORMANCE CRITERIA
3. Produce charts and graphs from given information	<p>3.1.Data is transposed accurately to produce charts or graphs.</p> <p>3.2.Charts or graphs accurately reflect data on which they are based.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing calculations involving whole numbers using all four basic rules
- performing calculations involving length, perimeter, area and volume
- checking calculated answers for accuracy
- rounding off estimated answers
- expressing information presented in fractional or decimal format as a percentage
- selecting appropriate formulae for the given application
- substituting the correct values for each term in the relevant formulae
- using appropriate mathematical operations
- performing calculations involving ratios or proportions
- determining required information from appropriate charts or graphs
- producing simple charts or graphs from given information or observations made
- selecting appropriate scales and using them in the production of charts and graphs
- marking appropriate limits clearly on the graph or chart
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- formula applicable to the determination of perimeter, area and volume of simple

**REQUIRED SKILLS AND KNOWLEDGE**

- geometric shapes
- techniques for estimating approximate answers
- reasons for using dimensions with the same units when calculating length, perimeter, area and volume
- concepts of perimeter, area and volume
- procedures for rounding off figures when estimating approximate answers
- mixed numbers, decimals, fractions and whole numbers
- concept of percentage
- procedures to be followed in converting a decimal to a percentage
- procedures for carrying out calculations involving fractions and using each of the four basic rules
- procedures to be followed on converting a fraction to a percentage
- sources of appropriate formulae
- reasons for ensuring that the units of each term are consistent with the formulae selected
- procedures for converting given units to those required for use in formulae
- concepts of ratio and proportion
- given ratios and proportions can be expressed in terms of whole numbers, fractions and decimal fractions
- scales applicable to the axes of the graphs or charts
- three types of charts and/or graphs used in the individual's field of work
- where appropriate, upper and lower limits of acceptability applicable to data entered on a graph or chart
- where appropriate, the trends indicated by the slope or gradient of a graph
- where appropriate, the action to be taken when given trends occur or set limits are approached on graphs or charts
- procedures for drawing 'lines of best fit'
- the trends indicated by the graphs or charts drawn
- hazards and control measures associated with performing computations, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform computations.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing computations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Relevant sources</b>	Charts, graphs, diagrams, measurement data, reference manuals and specifications
<b>Application</b>	Applications can include computations associated with pressure, volume, temperature, heat, speed, power, elasticity, density, mass, force etc.
<b>Arithmetic operations</b>	<ul style="list-style-type: none"> <li>• Application of subtraction, addition, multiplication and division</li> <li>• Manipulation of decimals, fractions and mixed numbers and whole numbers</li> <li>• Determining of percentages</li> <li>• Performing of algebraic expressions</li> <li>• Calculation of proportions and ratios</li> </ul>
<b>Charts and graphs</b>	Simple histograms, control charts, pie charts etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Measurement
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## MEM12025A Use graphical techniques and perform simple statistical computations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers interpreting and constructing graphs and charts from given or determined data, and performing basic statistical calculations.
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### Application of the Unit

<b>Application of the unit</b>	<p>Graphs and charts may be applied to information from various work contexts, quality processes, production and market trends and other engineering applications. A range of devices may be used to assist with calculations.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band:</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Read and construct graphs from given or determined data	1.1. Complex information is extracted from graphical representation. 1.2. Data is analysed with respect to emerging trends. 1.3. Graphs are constructed as required from data and drawn with respect to scale and accepted method. 1.4. Significant features of graphical representation are understood such as limit lines, gradients (straight line graphs), intercepts, maximum and minimum values. 1.5. A wide variety of graphs are constructed as required including histograms, control charts, straight line graphs and parabolic graphs.
2. Perform basic statistical calculations	2.1. Mean, median and mode are calculated from given data. 2.2. Standard deviation is calculated. 2.3. Application of standard deviation and limits to

ELEMENT	PERFORMANCE CRITERIA
	process improvement techniques is understood.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining required information by interpreting data presented in graphical form
- determining the trend(s) indicated by the data presented in graphical form
- constructing graphs to scale
- labelling the axes appropriately
- selecting scales appropriate to the purpose for which the graph is intended
- constructing histograms, control charts, straight line and parabolic graphs
- determining for a given set of data the mean, median and mode
- determining for a given set of data the standard deviation
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- checking for conformance to specifications
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics of straight line, parabolic and hyperbolic curves
- procedures for determining the slope/rate of change of a curve
- the trend(s) indicated by changes in gradient of a graph
- procedures for drawing the line of best fit for the coordinates plotted
- standard form of equations relating to straight lines and parabolic curves
- gradient, intercepts, maximum and minimum values and limit lines for straight line and parabolic curves
- function of control charts
- the meaning of the terms mean, median and mode

**REQUIRED SKILLS AND KNOWLEDGE**

- the meaning of the term standard deviation
- the significance of 1, 2 and 3 sigma limits
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to use graphical techniques and perform simple statistical computations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using graphical techniques and performing simple statistical computations or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

<b>EVIDENCE GUIDE</b>	
	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Process improvement techniques</b>	Techniques in which error rates are mathematically calculated and recorded such as three sigma and six sigma  <b>NOTE:</b> This unit gives the underpinning calculation skill for these techniques and does not cover the implementation or use of three or six sigma systems

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Measurement
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## MEM13001B Perform emergency first aid

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic emergency first aid, EAR (expired air resuscitation) and CPR (cardiopulmonary resuscitation).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to administration of basic emergency first aid treatment and the management of life threatening situations where an unconscious person requires expired air resuscitation (EAR) and cardiopulmonary resuscitation (CPR).</p> <p>This unit does not meet all of the requirements expected of designated First Aid Officers.</p> <p>The competencies required for situations involving isolation of persons from hazardous electrical situations are covered in Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c. and 1500 volts d.c.) and Unit MEM10003B (Install and test electrical wiring and circuits up to 1000 volts a.c. and 1500 volts d.c.).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Perform emergency first aid	<p>1.1. Correct procedures for EAR (expired air resuscitation) and CPR (cardiopulmonary resuscitation) are demonstrated on a mannequin.</p> <p>1.2. First aid treatment of injuries is carried out correctly.</p> <p>1.3. Details of first aid administered are accurately recorded.</p> <p>1.4. Understanding of relevant regulatory and legislative requirements is demonstrated.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing operations
- checking and clarifying task-related information
- performing EAR (expired air resuscitation) and CPR (cardiopulmonary resuscitation) on a mannequin
- simulated first aid treatment for the full range of injuries covered by the range statement
- reading, interpreting and following emergency first aid procedures and related documents
- entering information onto proformas and other relevant documents
- communicating effectively with injured persons, appropriate personnel and authorities

#### Required knowledge

Look for evidence that confirms knowledge of:

- applicable regulatory and legislative requirements
- use and application of any applicable personal protective equipment
- hazards and control measures associated with performing emergency first aid, including housekeeping
- instances where EAR and CPR should be performed
- procedures for preparing a person for the administration of EAR and CPR
- procedures for performing EAR and CPR on a child and an adult
- dangers and precautions to be taken when administering EAR and CPR
- emergency first aid procedures for injuries covered by the scope of this unit
- details to be recorded of first aid administered
- procedures and reasons for recording first aid administered
- relevant regulatory and legislative requirements with respect to emergency first aid
- the impact of regulatory/legislative requirements on the individual and others
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform emergency first aid.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing emergency first aid or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Injuries</b>	Burns/scalds, fractures, cuts and abrasions, poisoning, foreign bodies in eyes, concussion and shock

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM13002B Undertake occupational health and safety activities in the workplace

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying principles of Occupational Health and Safety (OHS) in the workplace and undertaking a safety risk assessment for the employee's area of responsibility.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to employees requiring additional OHS competencies beyond those inherent in their job.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 3</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply principles of OHS in a workplace	<p>1.1. Basic OHS principles of hazard identification, risk assessment and control are described.</p> <p>1.2. Understanding of OHS legislation as it is applied in the workplace is demonstrated.</p>
2. Carry out safety audit	2.1. Regular safety audits in the area of responsibility are carried out in accordance with appropriate OHS standards.
3. Identify health and safety improvements	<p>3.1. OHS issues and suggestions for improvements are made to OHS Representatives and Committees as appropriate.</p> <p>3.2. On the basis of safety audits or as required, hazards are identified and recommendations for their control are made.</p> <p>3.3. Contributions to safety improvements are made using standard operating procedures.</p> <p>3.4. OHS training needs are identified.</p>
4. Follow requirements of enterprise OHS program	4.1. Requirements of the OHS program are satisfied within the area of responsibility. This includes for example, accident investigation and emergency procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- performing safety audits
- making safety improvements
- initiating OHS training
- meeting requirements of the OHS program and procedures in the individual's area(s) of responsibility
- reading and interpreting audit and safety-related documentation
- following audit and OHS procedures
- entering information onto audit reports and other relevant documents
- communicating effectively about OHS activities with workplace personnel

#### Required knowledge

Look for evidence that confirms knowledge of:

- principles of hazard identification, assessment and control as applied to the workplace
- procedures for hazard identification, assessment and control
- application of OHS legislation in the workplace
- procedures for conducting safety audits
- safety standards applicable to the individual's area(s) of responsibility
- the frequency at which safety audits should be conducted
- procedures for implementing OHS improvements
- the means of rectifying given or identified hazards
- reasons for selecting the chosen means of rectifying the hazard
- the authority to whom recommended OHS improvements are to be reported
- procedures for making safety improvements
- requirement for OHS training in the individual's area(s) of responsibility
- objectives of OHS training
- procedures for initiating OHS training
- accident investigation procedures
- emergency OHS procedures
- the role of the individual in carrying out accident investigations and emergency procedures



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake OHS activities in the workplace.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with undertaking occupational health and safety activities in the workplace or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Risk assessment**

Risk assessment is a process that involves:

- analysing the risk to identify influencing factors and the range of potential consequences
- assessing:
  - the effectiveness of existing controls
  - the likelihood of each consequence considering exposure and hazard level
- and combining these in some way to obtain a level of risk

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM13003B Work safely with industrial chemicals and materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using personal protective equipment (PPEs), identifying the particular hazards and emergency procedures, and observing safe working practices in that environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit may be applied in a workplace in which materials and chemicals which are subject to codes and regulations are stored and used, for example, chemicals, solvents, dangerous materials, acids, noxious waste products etc.</p> <p>Evidence of competency is to encompass the satisfactory application of current State/Territory OHS legislation, standards and codes of practice, and the hierarchy of hazard control measures with elimination, substitution, isolation and engineering control measures being selected before safe work practices and PPEs.</p> <p>This unit describes the competencies which are beyond those safety requirements normally applied in the workplace as described in Unit MEM13014A (Apply principles of occupational health and safety in the work environment) or specifically described in individual units such as welding.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use personal protective equipment	1.1. Correct and appropriate safety clothing including personal protective equipment is selected and used correctly based on information in relevant material safety data sheet (MSDS).
2. Identify emergency procedures	2.1. Emergency procedures and plan relevant to the particular work environment are documented, understood and demonstrated as laid down in approved safety instructions.

ELEMENT	PERFORMANCE CRITERIA
3. Observe safe working practices	<p>3.1. Hazardous areas and materials are identified and special handling procedures are identified and understood.</p> <p>3.2. Permits to work (if necessary) are obtained.</p> <p>3.3. All equipment and hazardous materials are used in accordance with relevant OHS legislation, manufacturers' instructions and standard operating procedures.</p> <p>3.4. All site-specific safety policies, safety signs, symbols and labels are correctly identified and understood.</p> <p>3.5. Material safety data sheets are understood and applied.</p> <p>3.6. Safe manual handling procedures (including equipment) are used.</p> <p>3.7. Decanted chemicals and storage is to State/Territory dangerous goods and OHS legislation and requirements.</p> <p>3.8. Housekeeping duties are performed according to standard operating procedures to maintain a safe working environment.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking risk assessment
- communicating with others
- performing proper manual handling techniques
- interpreting safety signage, labelling and placarding

#### Required knowledge

Look for evidence that confirms knowledge of:

- dangerous goods classification and labelling/placarding
- testing, use and maintenance of PPE

**REQUIRED SKILLS AND KNOWLEDGE**

- inherent hazardous properties of the chemicals to be used
- interpretation of the relevant MSDS
- basic fire fighting procedures
- site-specific emergency plan procedures
- chemical spill confinement procedures
- dangerous occurrence (near miss) reporting procedures
- hierarchy of control

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to work safely and efficiently with various chemicals.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with working safely with industrial chemicals and materials or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Personal protective equipment**

Personal protective may include appropriate:

- goggles/face shields
- respirators
- air supplied or self-contained helmets
- safety boots, gloves and appropriate clothes/garments

**Safe working practices**

- Environment is inspected
- Hazards (and chemical reactive hazards) are assessed and controlled using hierarchy of hazard control
- Properly maintained PPE is available
- Emergency management plan is documented/understood



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>Work to be undertaken in safe 'thermal' environments and all possible ignition sources are to be identified and controlled</li> </ul>
<b>Storage</b>	All storage containers (minor quantities and in consumer packages) are suitable for chemical exposure and are properly labelled and/or placarded. Chemical manifests are updated at completion of work activity
<b>State or Territory legislative requirements</b>	Appropriate OHS, dangerous goods acts and regulations, Australian standards, Australian Code for the Transport of Dangerous Goods by Road and Rail (ADGC), NOHSC codes of practice

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM13004B Work safely with molten metals/glass

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers working safely with molten metals or glass including the appropriate use of personal protective equipment (PPE), identifying and responding to emergency procedures, observing safe work practices, and identifying the hazardous conditions in a heavy engineering environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit may be applied in all workplaces in which there is molten metal or molten glass, for example, in foundries, die casting operations, glass or molten glass operations, explosives manufacture.</p> <p>Evidence of competency is to encompass the satisfactory application of any current State/Territory OHS legislation, standards and codes of practice, and the hierarchy of hazard control measures with elimination, substitution, isolation and engineering control measures being selected before safe work practices and personal protective equipment.</p> <p>This competency is to be exhibited in accordance with all relevant OHS legislation.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the need for the use of personal protective equipment	1.1.Appropriate personal protective equipment is identified and used correctly, as specified in standard operating procedures (SOP) and OHS information relating to the specific hazard(s).
2. Adhere to emergency procedures for working with molten metal and glass	2.1.Emergency equipment is located and used in accordance with workplace policies and procedures. 2.2.Responses to emergency procedures are demonstrated as detailed in approved safety procedures and instructions.
3. Identify, assess and control hazardous	3.1.Hazards are identified and reported and planning is undertaken to maintain a healthy and safe work

ELEMENT	PERFORMANCE CRITERIA
conditions operating in a heavy engineering environment	environment. 3.2.Workplace procedures and work instructions for controlling risks are followed accurately.
4. Observe good OHS practices	<p>4.1.Hazardous areas and materials associated with molten metal/glass are identified and potential risks are identified.</p> <p>4.2.Safety signs and symbols are identified and understood.</p> <p>4.3.Equipment (including personal protective equipment) is used according to specifications and standard operating procedures.</p> <p>4.4.Personal protective equipment is inspected and maintained in good order and stored for reuse.</p> <p>4.5.Hazardous items associated with task are identified and removed from hot material area if required and assessed and controlled.</p> <p>4.6.Housekeeping duties are performed according to standard operating procedure to maintain a safe working environment and include the safe use, accessibility and maintenance of PPEs.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using appropriate personal protective equipment
- responding to emergency procedures (fires, accidents etc.)
- handling hazardous materials and equipment within the scope of this unit
- maintaining equipment
- housekeeping
- identifying and reporting hazardous conditions and taking actions to rectify hazards
- interpreting text and numerical (e.g. quantities, units of measurement) information on material safety data sheets, safety signs, symbols and labels
- using manual handling techniques

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- hazards, hazardous areas and materials and hazard control measures associated with molten metal/glass
- hierarchy of control
- procedures relevant to raising OH&S issues
- rights and responsibilities of workplace parties under OH&S acts, regulations, codes of practice etc.
- designated personnel responsible for OH&S
- applicable personal protective equipment
- emergency procedures
- safety signs, symbols and labels
- procedures for correct inspection and service of equipment including personal protective equipment
- routine maintenance procedures for equipment
- workplace procedures for working in hazardous areas
- the consequences of not maintaining a clean and safe working environment
- specific hazards associated with the work environment/industry
- safe manual handling procedures
- location of emergency equipment including first aid facilities

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to work safely with molten metals/glass.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

<b>EVIDENCE GUIDE</b>	
<b>assessment</b>	<p>combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with working safely with molten metals/glass or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Personal protective equipment</b>	<ul style="list-style-type: none"> <li>• Face protection</li> <li>• Eye protection</li> <li>• Respiratory protection</li> <li>• Hearing protection</li> <li>• Hand protection</li> <li>• Clothing and footwear protection</li> </ul>
<b>Risk</b>	Likelihood and consequences of injury or damage
<b>Hazardous material</b>	<ul style="list-style-type: none"> <li>• Hot material</li> <li>• Molten metals</li> <li>• Molten glass and associated products etc.</li> <li>• Explosive materials</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM13006B Collect and evaluate occupational health and safety data for an enterprise or section of an enterprise

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers carrying out standard OHS measurements, collecting and evaluating data, maintaining records and reporting hazards.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the taking of routine OHS measurements. Data collected would typically relate to factors associated with temperature, noise (noise meter), dust (draeger tubes).</p> <p>This unit should not also be selected where Unit MEM15010B (Perform laboratory procedures) has been selected.</p> <p>Where complex procedures or complex analysis are required, the services of an occupational health and safety (OHS) hygienist should be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Carry out standard OHS measurement	1.1.Data is collected using standard equipment in accordance with manufacturers' specifications.
2. Evaluate data	2.1.Data from measurements taken is evaluated to identify non-conformance with OHS standards.
3. Report outcomes of data evaluation	3.1.Results requiring remedial action are reported to appropriate personnel using standard operating procedures. 3.2.Reports are prepared correctly to detail data findings. 3.3.Non-compliances and non-conformances are reported and recorded.

ELEMENT	PERFORMANCE CRITERIA
4. Maintain records	4.1. Records are maintained in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings, data and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- preparing reports
- checking conformance to specifications
- using calculations and numerical operations within the scope of this unit
- taking and recording required measurements in accordance with manufacturers' specifications and standard operating procedures
- maintaining records of the OHS factors monitored in accordance with standard operating procedures
- detecting and reporting hazards in accordance with standard operating procedures

#### Required knowledge

Look for evidence that confirms knowledge of:

- the measurements to be taken and recorded
- the procedures for taking each type of measurement
- the tools, techniques and equipment required to carry out the measurements
- the OHS standards for each factor being measured
- variations between the data collected and the appropriate OHS standard
- probable causes of the variation of the data collected from the OHS standard
- the procedures for maintaining records of OHS factors measured
- the procedures for reporting hazards
- the authority to whom hazards are to be reported
- hazards and control measures associated with collecting and evaluating occupational health and safety data for an enterprise or section of an enterprise,

## REQUIRED SKILLS AND KNOWLEDGE

- including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to collect and evaluate occupational health and safety data for an enterprise or section of an enterprise.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with collecting and evaluating occupational health and safety data for an enterprise or section of an enterprise or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

## EVIDENCE GUIDE

	and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Data</b>	Factors associated with temperature, noise (noise meter), dust (draeger tubes)
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## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM13007B Maintain water treatment systems for cooling towers

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers testing water treatment as specified by Australian Standard AS 3666 or equivalent, measuring water properties, and maintaining reticulation/treatment systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the maintenance activities associated with water reticulation systems and includes water testing for microbial, acidic, and/or alkaline levels of tower water.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply principles of Australian Standard 3666 or equivalent	1.1.Causes of corrosion, scale, algae and treatment/prevention can be explained. 1.2.Air distribution of cooling towers can be explained.
2. Assess reticulation system	2.1.Relevant water conditions are assessed against specifications using standard procedures and test equipment. 2.2.Condition of water circulation system is assessed and appropriate action determined. 2.3.Performance of regulating, filtering, conditioning/dosing and pumping systems is assessed against specification.
3. Measure relevant water properties	3.1.Test equipment is correctly used and applied. 3.2.Water properties are accurately determined/recorded.
4. Maintain reticulation/treatment systems	4.1.Water temperature control system is recorded and non-compliances are reported. 4.2.Dosing is adjusted to specification. 4.3.Faults are reported to appropriate personnel according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing operations
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- testing the condition of the water in the cooling tower/treatment system
- testing dosing components for correct operation/performance
- testing water properties using appropriate techniques and equipment
- checking for conformance to specifications
- determining and recording test results
- adjusting dosing flow in the system to specification
- reporting system faults to appropriate personnel

#### Required knowledge

Look for evidence that confirms knowledge of:

- causes of corrosion, scale and algae
- methods of treating/preventing occurrence of corrosion, scale and/or algae in water cooling towers and treatment systems
- the air flow patterns of cooling towers
- the testing requirements of AS 3666 and/or other relevant regulations relating to water cooling towers
- precautions for preventing contamination of systems by legionella bacteria
- procedures for testing the condition of the water in the cooling tower
- specifications of the water condition
- variations of the test results from specification
- procedures to be followed when water condition varies from specification
- the correct operation/performance of the following system components: regulators, filters, conditioners and pumps related to treatment systems
- performance tests for treatment system components
- water properties to be tested
- procedures for testing water properties



**REQUIRED SKILLS AND KNOWLEDGE**

- test equipment and techniques
- water temperature specifications
- procedures for reporting system faults
- codes and regulations relevant to maintaining water treatment systems
- hazards and controls associated with maintaining water cooling towers and treatment systems, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain water cooling towers and treatment systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining water cooling towers and treatment systems or other units requiring the exercise of the skills

<b>EVIDENCE GUIDE</b>	
	and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Relevant water conditions</b>	<ul style="list-style-type: none"> <li>• Acidity</li> <li>• Alkalinity</li> <li>• Microbial</li> <li>• Corrosion</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Occupational health and safety
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## MEM13010A Supervise occupational health and safety in an industrial work environment.

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers supervising implementation of OHS practices and procedures in a section of a workplace that is within an industrial workplace.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a person who requires the skill and knowledge to supervise others in the implementation and monitoring of occupational health and safety (OHS) of a workplace section. It applies to manufacturing, production, engineering and related industry environments.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13002B	Undertake occupational health and safety activities in the workplace

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Implement OHS procedures for work site or section	<p>1.1. Legislative requirements for the work section and work supervisor are identified.</p> <p>1.2. Consultation mechanisms are established for the work section.</p> <p>1.3. Personal Protective Equipment (PPE) is allocated to all staff as required.</p> <p>1.4. Safety and housekeeping practices and procedures are established for the work site or section.</p> <p>1.5. Tools and equipment are checked for suitability and serviceability.</p> <p>1.6. Safety monitoring procedures are established.</p> <p>1.7. Non-conformances with legislative requirements are</p>

ELEMENT	PERFORMANCE CRITERIA
	assessed and addressed.
2. Assess risks in the work site or section	2.1. Hazards in the work site or section are identified. 2.2. Risks are assessed.
3. Apply risk management strategies for work section	3.1. Appropriate risk control measures are implemented. 3.2. Control measures are assessed for effectiveness in controlling the risk. 3.3. Hazards are monitored. 3.4. The need for expert advice to manage risks is determined. 3.5. Accident investigations are conducted as required to determine cause.
4. Supervise others in the implementation of OHS procedures in the work site or section	4.1. Communication on OHS matters is supervised. 4.2. OHS training needs are identified for the work section. 4.3. Workplace OHS training and communication activity is coordinated, evaluated and documented according to legislative requirements and organisational procedure. 4.4. Statutory OHS training requirements are coordinated and documented according to legislative requirements and organisational procedure.
5. Maintain records and statistics	5.1. Accident/incident records are maintained. 5.2. Records are analysed for trends, and particular problem areas are identified.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- keeping records/minutes of discussions with consultative forums on OHS matters
- scheduling meetings with the relevant consultative forums to discuss OHS matters
- participating in consultative forums
- communicating with staff regarding OHS matters

## **REQUIRED SKILLS AND KNOWLEDGE**

- identifying OHS training needs in the workplace
- supervising OHS training implementation
- interpreting and following information on OHS legislation, workplace practices and procedures, written job instructions, specifications, standard operating procedures, charts, lists, and other applicable reference documents
- keeping records for monitoring the effectiveness of work practices and procedures with respect to the safety of the working environment
- investigating accidents in accordance with standard workplace procedures
- obtaining results of safety audits in accordance with workplace procedures
- obtaining expertise external to the workplace to assist in the identification and control of workplace hazards
- maintaining accident and incident records in accordance with standard workplace procedures

### **Required knowledge**

Look for evidence that confirms knowledge of:

- legislative requirements for the workplace and supervisory responsibilities
- procedures for initiating discussions with the relevant consultative forums
- relevant consultative forums
- the frequency of discussions to be held with the relevant consultative forums
- organisational OHS communication requirements
- OHS training practices, procedures and options available
- work practices and procedures developed in conjunction with the relevant consultative forums
- the effect of work practices and procedures on the safety of the working environment
- procedures for monitoring the success of the work practices and procedures developed
- variables to be recorded during the monitoring process
- sources of information on occupational health and safety issues
- procedures for conducting accident investigations
- the hierarchy of hazard control measures
- reasons for progressively implementing the hierarchy of control of hazards
- the likely causes of accidents investigated
- principles of hazard control
- the mechanisms for controlling hazards
- the areas of occupational health and safety for which the workplace lacks acknowledged expertise
- procedures for accessing expertise external to the workplace
- procedures for recording accidents and incidents
- the probable causes of trends or problem areas

## REQUIRED SKILLS AND KNOWLEDGE

- hazards and control measures relevant for the work site or section, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to supervise occupational health and safety in an industrial work environment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with supervising occupational health and safety in an industrial work environment or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be



<b>EVIDENCE GUIDE</b>	
	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Consultation mechanisms</b>	OHS committees, OHS representation, toolbox meetings, safety meetings, record keeping systems
<b>Personal Protective Equipment</b>	Safety boots, gloves, goggles, glasses, ear muffs, hard hats, clothing, respirators or masks, reflective vests
<b>Safety and housekeeping practices and procedures</b>	Emergency/evacuation procedures, tool and equipment cleaning, maintenance and storage procedures, safety reporting and documentation procedures, barricades and signage, procedures for managing hazardous chemicals and materials
<b>Hazards</b>	Risks associated with tools and equipment, lighting, gases, electricity and water, toxic and hazardous substances, flammable materials and fire hazards, lifting practices, working in confined spaces, working at height, spillage, waste and

<b>RANGE STATEMENT</b>	
	debris, noise, mobile plants such as forklifts and front end loaders, moving parts of machinery, gravity (falls from heights), dusts
<b>Risks</b>	The chance of something happening that will result in injury or damage. It is measured in terms of consequences and likelihood
<b>Risk control measures</b>	Elimination of the hazard, substitution with a lesser hazard, isolation of personnel from the hazard, engineering controls, administrative controls (e.g. procedures and training), personal protective equipment
<b>Communication</b>	Signage and labelling, hazard identification notices, access to policies, procedures, SOPs, etc., meeting notices, documentation procedures, reporting procedures, meetings
<b>Supervised</b>	Coordinated, implemented, referred, delegated, facilitated, monitored, documented
<b>Training needs</b>	Induction programs, technical training, coaching and mentoring, supervision, specialist training, on site/off site, involvement of training specialists, organisational training requirements, referral to training personnel

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Occupational health and safety
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## MEM13013B Work safely with ionizing radiation

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers working safely with ionizing radiation when performing radiographic testing in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to safely working with ionizing radiation in open or closed sites: on fabrications, structures and components across a wide range of industries. It is a prerequisite to undertaking any other radiographic competency standards unit. The work can relate to scheduled and unscheduled maintenance activities, using general tools, specific radiographic testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>All testing must be completed with particular attention to personal and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - must be subject to safe work habits must be stored and used in accordance with safe work practices.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units	
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## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the hazards and effects of ionizing radiation in the workplace	1.1.The source of ionizing radiation is identified in accordance with relevant organisational policy and procedures. 1.2.Production of X-rays and gamma rays is explained in relation to radiographic testing activities. 1.3.Attenuation factors of ionizing radiation and the biological effects on living tissue are outlined. 1.4.The biological effects of radiation are identified.
2. Apply radiation safety procedures/plans	2.1.Appropriate ionizing radiation protective measures are employed in accordance with relevant organisational policy and procedures.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.2.SI units of radiation are explained as per the National Health and Medical Research Council/ statutory requirements.</p> <p>2.3.Exposure limits for personnel as laid down by the radiation authorities in Australia are stated and adhered to.</p> <p>2.4.Minimum exposure rates/distances are determined from calculations and charts.</p> <p>2.5.Ionizing radiation sources are operated in accordance with legislation, standards and/or organisational policy, procedures or guidelines.</p>
3. Select and use radiation monitoring equipment	<p>3.1.The tools and equipment necessary to monitor radiation are selected and used as required.</p> <p>3.2.Techniques and system verification checks necessary to monitor radiation are selected and applied.</p> <p>3.3.Safety breaches are documented and/or reported in accordance with organisational policy and procedures.</p>
4. Respond to emergency situations	<p>4.1.Procedures for dealing with both X-ray and gamma ray emergency situations are demonstrated.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- calculating and numerical operations within the scope of this unit
- reading and interpreting charts, written job instructions, specifications, standard operating procedures, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related operations
- checking for conformance to specifications
- using monitoring equipment
- calculating and monitoring radiation

## REQUIRED SKILLS AND KNOWLEDGE

- handling emergencies
- following safety requirements
- assessing risk

### Required knowledge

Look for evidence that confirms knowledge of:

- properties of X-rays and gamma rays and principal radioactive sources used in industrial radiography
- attenuation factors
- known biological effects of radiation
- general principles of gas ionisation, photographic effect, luminescence
- use of film, film badges, ionisation chamber devices, quartz fibre, fluorescent, electronic devices accuracy limits (energy/range)
- different SI units of radiation including becquerel, sievert and gray
- exposure limits for personnel as laid down by the radiation authorities in Australia
- the three exposure reduction factors including: time, distance and shielding
- procedures for establishing safe working barriers
- relevant techniques and checks
- emergency procedures
- safety procedures including for:
  - types of X-ray equipment
  - types of isotope cameras
  - shielding materials
  - design and requirements for exposure areas
  - requirements for storage of radioisotopes
- emergency situations, causes and appropriate responses
- hazards and control measures associated with ionizing radiation, including housekeeping
- storage requirements of equipment and materials
- use and application of personal protective equipment
- safe workplace practices and procedures
- legal requirements including;
  - Australian/NSW regulations, code of practice (detail)
  - ICRP recommended limits for various persons and various parts of the body for short-term, long-term and accumulated exposure
  - background radiation
  - duties of RSO
  - requirements for transport
  - IATA regulations

**REQUIRED SKILLS AND KNOWLEDGE**

- obligations of the licensee

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to safely work with ionizing radiation when performing radiographic testing.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with radiographic testing or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate



<b>EVIDENCE GUIDE</b>	
	must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Relevant organisational policy and procedures</b>	<ul style="list-style-type: none"> <li>• Legislation</li> <li>• Standard operating procedures (SOPs)</li> <li>• Australian or international standards</li> <li>• Risk assessments</li> <li>• Previous testing reports</li> <li>• Manufacturer specifications</li> </ul>
<b>Production of X-rays and gamma rays</b>	<ul style="list-style-type: none"> <li>• Atomic structure, protons, neutrons, electrons, atomic number, mass number, isotopes</li> <li>• Electromagnetic radiation wavelength, frequency, energy relationships, intensity</li> <li>• Construction and operation of X-ray tube anode, cathode, target</li> <li>• Gas and coolidge tubes</li> <li>• Glass and ceramic tubes</li> <li>• X-ray spectrum</li> <li>• Characteristic and continuous spectra effect of voltage and current on continuous spectra</li> <li>• Efficiency</li> <li>• Natural and artificial radioisotopes</li> <li>• Production of radioisotopes</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>Decay mechanisms, alpha, beta-, beta+, and gamma</li> <li>Concept of half life, decay constants</li> <li>Selection of gamma ray sources</li> <li>Units definition of curie, becquerel, conversion of units, multiple units (e.g. GBq), nuclide chart</li> </ul>
<b>Biological effects of radiation</b>	<ul style="list-style-type: none"> <li>Ionisation, absorption, scatter (Compton, Rayleigh, photo-electric, pair production)</li> <li>Attenuation coefficient, absorption edges</li> <li>Units roentgen, rad, coulomb/kg, gray conversions</li> <li>Effects of varying doses on living tissue</li> <li>Somatic effects, genetic effects, cell biology nucleus, cytoplasm</li> <li>DNA, chromosome, mitosis; symptoms, effect of time, ICRP recommendations</li> <li>Dose, dose equivalent, RBE, rem, seivert, conversions</li> <li>Occupancy factor</li> </ul>
<b>Protective measures</b>	<ul style="list-style-type: none"> <li>Personal protective equipment (PPE) including for risks other than ionizing radiation</li> <li>Safety protocols of workplace (e.g. flame limitations in refineries)</li> <li>Signage, barriers/guards</li> <li>Limitations on operation of specific equipment/machines</li> </ul>
<b>Minimum exposure</b>	<ul style="list-style-type: none"> <li>Time, distance, shielding effect of distance, inverse square law</li> <li>Half and tenth value layers</li> <li>Emergency procedures, company procedure codes</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Occupational health and safety
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## MEM13014A Apply principles of occupational health and safety in the work environment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers following occupational health and safety procedures in an engineering or similar work environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers essential skills and knowledge that underpin all units within the Metal and Engineering Training Package. The unit applies to working in the engineering, manufacturing or similar industries. Competencies demonstrated would be associated with performance of duties and use of specialist skills.</p> <p>This unit and these standards do not cover the skills of emergency teams such as fire fighting, first aid officer etc.</p> <p><b>Band: A</b></p> <p><b>Unit Weight:</b> There is no unit weighting for this unit.</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Follow safe work practices	<p>1.1. Work is carried out safely and in accordance with company policy and procedures and legislative requirements.</p> <p>1.2. Housekeeping is undertaken in accordance with company procedures.</p> <p>1.3. Responsibilities and duties of employees are understood and demonstrated in day-to-day actions.</p> <p>1.4. Personal protective equipment is worn and stored according to company procedures.</p> <p>1.5. All safety equipment and devices are used according to legislative requirements and company/manufacturers' procedures.</p> <p>1.6. Safety signs/symbols are identified and followed as per instruction.</p> <p>1.7. All manual handling is carried out in accordance with legal requirements, company procedures and National</p>

ELEMENT	PERFORMANCE CRITERIA
	Occupational Health&Safety Commission guidelines. 1.8.Emergency equipment is identified and appropriate use is demonstrated.
2. Report workplace hazards and accidents	2.1.Actual and foreseeable workplace hazards are identified during course of work and reported to appropriate person according to standard operating procedures. 2.2.Accidents and incidents are reported according to workplace procedures
3. Follow emergency procedures	3.1.Appropriate personnel and emergency services and means of contacting them in the event of an incident can be identified. 3.2.Emergency and evacuation procedures are understood and carried out where required. 3.3.Company evacuation procedures are followed in case of an emergency.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- following safe working practices
- maintaining a safe and clean condition workplace
- carrying out workplace activities such as working safely, not endangering others, following company and legislative requirements, following procedures
- selecting, wearing and storing appropriate personal protective equipment
- using appropriate safety equipment and devices
- carrying out work with the information given by safety signs and symbols
- carrying out manual handling principles
- using emergency equipment correctly
- noting workplace hazards
- contacting appropriate personnel and emergency services in the event of an accident
- following emergency and evacuation procedures

## REQUIRED SKILLS AND KNOWLEDGE

- communicating and interpreting information appropriate to OH&S within the scope of this unit
- checking and clarifying task-related information
- communicating with emergency personnel
- checking for conformance to specifications

### Required knowledge

Look for evidence that confirms knowledge of:

- rights, responsibilities and duties of employees and employers
- use of personal protective equipment
- appropriate equipment and safety devices for particular workplace tasks
- reasons for using safety equipment and devices
- meaning and application of safety signs and symbols
- procedures and limits for manual handling
- location and use of emergency equipment
- reasons for selecting a particular type of equipment
- procedures for identifying and reporting hazards
- persons or services to be contacted in the event of a range of accidents
- reasons for use of standard procedures
- standard procedures including those for emergencies and evacuation
- hazards and housekeeping requirements associated with the work environment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply principles of occupational health and safety in the work environment.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying principles of occupational health and safety in the work environment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating</p>



<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Personal protective equipment</b>	<ul style="list-style-type: none"> <li>• Safety glasses</li> <li>• Face and head protection</li> <li>• Hard hats</li> <li>• Protective footwear</li> <li>• Protective clothing</li> <li>• Breathing apparatus</li> <li>• Ear protection</li> <li>• Gloves</li> </ul>
<b>Safety equipment and devices</b>	<ul style="list-style-type: none"> <li>• Safety harness</li> <li>• Screens, barriers and shielding</li> <li>• Extraction fans</li> <li>• Machine guards</li> <li>• Isolation devices</li> </ul>
<b>Safety signs/symbols</b>	<ul style="list-style-type: none"> <li>• Standard signage/symbols conforming to AS 1319-1994</li> <li>• Safety signs for the occupational environment, and any other applicable Australian Standards</li> <li>• Workplace-specific signage</li> <li>• Typical classes of relevant signs/symbols are: <ul style="list-style-type: none"> <li>• mandatory</li> <li>• prohibition</li> <li>• danger</li> <li>• caution</li> <li>• general safety</li> <li>• safety information</li> <li>• fire safety equipment</li> </ul> </li> </ul>
<b>Manual handling</b>	Posture, weight limits, bending, twisting
<b>Hazards</b>	<p>For the purposes of this unit a hazard is defined as anything with the potential for injury or damage. Hazards may be:</p> <ul style="list-style-type: none"> <li>• physical: <ul style="list-style-type: none"> <li>• machinery</li> <li>• hot metal</li> <li>• electricity</li> <li>• fire</li> </ul> </li> </ul>

## RANGE STATEMENT

	<ul style="list-style-type: none"> <li>• poor housekeeping: <ul style="list-style-type: none"> <li>• spills</li> <li>• trip hazards such as congestion, clutter, waste build-up</li> <li>• cleanliness</li> </ul> </li> <li>• noise and vibration</li> <li>• extremes of temperature and humidity</li> <li>• condition/design of equipment</li> <li>• individual (behavioural): <ul style="list-style-type: none"> <li>• skylarking and foolishness</li> <li>• substance abuse</li> <li>• failure to follow procedures</li> <li>• lack of training or experience</li> <li>• carelessness</li> <li>• poor personal health/hygiene</li> <li>• using the wrong techniques/procedures</li> <li>• ignoring safety rules and signs</li> <li>• taking short cuts</li> <li>• knowingly using unsafe equipment</li> </ul> </li> <li>• environmental hazards: <ul style="list-style-type: none"> <li>• explosive materials</li> <li>• flammable materials</li> <li>• poor ventilation</li> <li>• poor lighting</li> <li>• dust</li> <li>• fumes</li> <li>• vapours</li> <li>• gases</li> <li>• liquids</li> <li>• mineral fibres</li> <li>• chemical spills</li> <li>• pollutants</li> <li>• other toxic or dangerous materials</li> </ul> </li> </ul>
<b>Accidents and incidents</b>	<p>For the purposes of this unit an accident is defined as 'an unplanned and unexpected event which interrupts the normal course of activity. It may or may not result in damage or injury'. This definition includes near misses.</p>

<b>RANGE STATEMENT</b>	
	<p>An incident is defined here as any other unexpected or extraordinary event not classed as an accident. Examples include:</p> <ul style="list-style-type: none"> <li>• burns</li> <li>• poisoning</li> <li>• broken limbs</li> <li>• eye accidents</li> <li>• other injuries</li> <li>• spills</li> <li>• explosions</li> <li>• falls</li> <li>• electrical accidents</li> <li>• breakdowns</li> <li>• damage to equipment or materials/product</li> <li>• incidents involving physical, individual or environmental hazards</li> </ul>
<b>Appropriate personnel</b>	<ul style="list-style-type: none"> <li>• Safety representative</li> <li>• Occupational health and safety officer</li> <li>• OHS committee member</li> <li>• First aid officer</li> <li>• Supervisor</li> <li>• Union representative</li> </ul>
<b>Emergency and evacuation procedures</b>	Documented workplace emergency procedures

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Occupational health and safety
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## MEM14001B Schedule material deliveries

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying material requirements and scheduling material delivery.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the estimating, planning and scheduling of material deliveries so that materials are available in quantities and specifications required.</p> <p>This unit is not intended to be used by personnel carrying out maintenance and installation.</p> <p>If scheduling is based on engineering drawings and supporting engineering data, appropriate skill units should be accessed.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify material requirements	1.1. Materials required are identified from appropriate documentation including type and quality. 1.2. Quantities required are estimated in accordance with standard operating procedures.
2. Schedule material delivery	2.1. Delivery requirements and dates are determined from production plans or job sequencing requirements. 2.2. Material supply is followed up and problems reported. 2.3. Material orders are processed in accordance with established organisational practice and procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- communicating
- planning
- assessing
- reading and interpreting engineering specifications
- organising information
- prioritising
- entering routine and familiar information onto proformas and standard workplace forms

### Required knowledge

Look for evidence that confirms knowledge of:

- identification of material specifications from appropriate documentation
- established organisational practice and procedures relating to estimating, ordering and follow up of materials
- interpretation of production plans, or job sequencing requirements
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to plan and schedule material deliveries.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the planning and scheduling of material deliveries or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



RANGE STATEMENT	
Appropriate documentation	Bills of materials, parts lists, catalogues, service manuals, engineering drawings etc.
Schedule	Undertaken in accordance with established organisational practices and procedures, based on familiar processes

### Unit Sector(s)

Unit sector	
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### Co-requisite units

Co-requisite units		

### Competency field

Competency field	Planning
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## MEM14002B Undertake basic process planning

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers reviewing process specifications and determining the production sequence.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to one of a range of processes in manufacturing: machining, pressing, assembly and to a stage of the overall production process.</p> <p>It does not apply to interfacing between processes.</p> <p>If planning is based on engineering drawings and supporting engineering data, appropriate skills units should be accessed.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Review process specifications	1.1.Supporting engineering and production data is examined, where required. 1.2.The production processes to be used are determined. 1.3.Specifications are obtained and examined.
2. Determine production sequence	2.1.Steps required for the process are identified and flow charts are produced where required in accordance with standard operating procedures. 2.2.Material and parts lists are prepared in accordance with standard operating procedures. 2.3.Tooling and/or equipment requirements are documented in accordance with standard operating procedures. 2.4.Quality assurance steps and specifications are identified and incorporated into process steps. 2.5.Process steps are documented and clearly represented in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading and interpreting engineering and production data
- preparing flow charts
- communicating
- planning
- assessing
- reading and interpreting engineering specifications
- organising information
- prioritising

#### Required knowledge

Look for evidence that confirms knowledge of:

- production processes found within the organisation
- tooling and/or equipment requirements for workplace processes
- quality assurance requirements
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to undertake basic process planning.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>EVIDENCE GUIDE</b>	
	knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with basic process planning or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Production processes</b>	Work planned over a specified timeframe, taking into account required and available resources
<b>Steps</b>	Steps and milestones against which progress can be checked

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Planning
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## MEM14003B Undertake basic production scheduling

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying production requirements and capacities and preparing schedules for production of a component/part.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to the scheduling of the manufacture of a single component, or a single assembly function, or for a single small production work unit or production cell, or a single production process where there are only a small number of constraints or variables.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify production requirements and capacities	<ul style="list-style-type: none"><li>1.1.Engineering production data is identified and obtained in accordance with workplace procedures.</li><li>1.2.Inventory capacities and requirements are identified and obtained in accordance with workplace procedures.</li><li>1.3.Procurement and supply requirements and constraints are identified and obtained in accordance with workplace procedures.</li><li>1.4.Production capacity and constraints are identified and obtained in accordance with workplace procedures.</li><li>1.5.Standard times are identified and obtained in accordance with workplace procedures.</li></ul>
2. Prepare schedule for production of a component/part	<ul style="list-style-type: none"><li>2.1.Production of component is scheduled in accordance with production, inventory, procurements, time constraints, supply capacities and requirements.</li><li>2.2.Schedule is documented in accordance with accepted organisation procedures.</li></ul>



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading and interpreting production process data and procedure
- prioritising
- communicating
- time management
- organising
- documenting
- using project management tools such as Gantt Charts
- analysing
- performing arithmetic calculations

#### Required knowledge

Look for evidence that confirms knowledge of:

- scheduling techniques
- production methods
- quality assurance requirements
- inventory policies
- procurement, supply requirements and constraints
- general staffing levels, capabilities and application of standard times
- machine set-up, capability and application of standard times
- enterprise safety requirements and directives

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to schedule basic production.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with basic scheduling or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Planning
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## MEM14004A Plan to undertake a routine task

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers a person planning their own work where tasks involve one or more steps or functions and are carried out routinely on a regular basis. It includes the concepts of following routine instructions, specifications and requirements.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers essential skill and knowledge that underpin all units within the Metal and Engineering Training Package.</p> <p>Instructions, such as standard operation sheets, are provided. Clear specifications and requirements, including quality and time allowances are also provided. The task and associated planning activity are carried out under supervision. The plan may or may not be documented. The task involves one or more steps or functions carried out routinely on a regular basis. The planning activity does not require judgment to be made in relation to priorities or time limitations.</p> <p><b>Band: A</b></p> <p><b>Unit Weight:</b> There is no unit weighting for this unit.</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify task requirements	<p>1.1. Instructions and procedures are obtained, understood and where necessary clarified.</p> <p>1.2. Relevant specifications for task outcomes are obtained, understood and where necessary clarified.</p> <p>1.3. Task outcomes are identified.</p> <p>1.4. Task requirements such as completion time and quality measures are identified.</p>
2. Plan steps required to complete task	<p>2.1. Based on instructions and specifications provided, the individual steps or activities required to undertake the task are understood and where necessary clarified.</p> <p>2.2. Sequence of activities is identified.</p>

ELEMENT	PERFORMANCE CRITERIA
	2.3. Plan is checked to ensure it complies with specifications and task requirements.
3. Review plan	3.1. Effectiveness of plan is reviewed against specifications and task requirements. 3.2. If necessary, plan is revised to better meet specifications and task requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining instructions for tasks from correct source of information (job card, supervisor, work colleagues and others)
- clarifying tasks and required outcomes with appropriate personnel where necessary
- identifying relevant specifications from documentation, job cards, or other information source
- preparing plans for tasks
- sequencing activities
- comparing planned steps against specifications and task requirements
- communicating and interpreting information appropriate to the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- correct sources of information for a particular task
- procedures for obtaining instructions and clarification
- specifications for the task
- hazards and established control measures associated with the routine task, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to plan to undertake a routine task.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning to undertake a routine task or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

#### Guidance information for assessment



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Specifications

- Specific product or process information, such as:
  - outcome and performance requirements
  - quality requirements and checks
  - quantity
- Specifications are conveyed verbally or on familiar standard forms, such as on job sheets

#### Requirements

- General requirements necessary to carry out routine tasks, such as:
  - dedicated tools and equipment
  - materials and parts
  - work procedures
  - completion time
  - safety measures and equipment
- Requirements and instructions are supplied verbally or on familiar standard forms, such as on job sheets. Instructions are carried out under supervision and in accordance with established procedures

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Planning
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## MEM14005A Plan a complete activity

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning activities which, whilst following established procedures, may require a response and modification of procedures or choice of different procedures to deal with unforeseen developments.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit covers the development of plans for individual complete activities and may include the use of planning techniques and tools.</p> <p>The activity may require prioritising of the individual plan components to facilitate the meeting of the objectives. Examples of activities to be planned may include: fault diagnosis and repair of an item of equipment, a modification of an established sequence of assembly tasks. However the activities may require a response and modification of procedures or a choice of different procedures to deal with unforeseen developments.</p> <p>Activities are normally performed by the individual undertaking the planned activity, and associated reports are completed as required. Planning will be related to familiar work tasks and environments and be performed to standard operating procedures.</p> <p>Where more extensive reporting requiring research and forming conclusions is required, refer to Unit 16.14 (Report technical information).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify activity requirements	1.1.Activity outcomes and objectives are identified and clarified with appropriate persons. 1.2.Activity requirements, including resources, overall timeframe, quality requirements and criteria for acceptable completion are identified and clarified. 1.3.Relevant specifications and procedures are obtained

ELEMENT	PERFORMANCE CRITERIA
	and clarified.
2. Plan process to complete activity	<p>2.1.The individual components of the activity are identified and prioritised.</p> <p>2.2.Planning tools and techniques are selected and used according to the needs of the activity.</p> <p>2.3.The plan is checked for accuracy and conformance to instructions and requirements.</p>
3. Modify plan	<p>3.1.The plan is referred to and modified as necessary to overcome unforeseen difficulties or developments that occur as work progresses.</p> <p>3.2.The results of the activity are reviewed against the plan, and possible future improvements to plan are identified.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawing and other applicable reference documents
- preparing a plan including sequential steps that will enable the activity to be completed
- modifying the plan where appropriate, to take account of difficulties or developments that occur while following the prepared plan
- planning and sequencing activities
- checking and clarifying task-related information
- checking for conformance to specifications
- using numerical operations, geometry and calculations/formulae within the scope of this unit
- using planning techniques such as scheduling, time management, brainstorming, setting of goals and defined outcomes, prioritising, review and evaluation strategies

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- tasks to be performed
- person/s who can clarify the objectives, requirements and specifications
- specifications relevant to the tasks to be performed
- outcomes to be achieved
- timeframe for activity completion
- quality requirements of the product or service
- priority of each step in the plan
- reasons for the relative priority of each step
- modifications to the plan to overcome a range of unforeseen situations
- hazards and control measures associated with planning the complete activity, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to plan a complete activity.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

**EVIDENCE GUIDE**

	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning a complete activity or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Requirements**

- Formal or informal information about the task required, such as:
  - timeframe
  - quality requirements
  - outcome and performance requirements
  - job history
  - checks and tests
  - special reporting requirements

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• tools and equipment</li> <li>• materials and parts</li> <li>• reference documents</li> <li>• Requirements and instructions are supplied verbally or in written form such as on job sheets. Instructions are carried out in accordance with established procedures</li> </ul>
<b>Specifications</b>	Technical task related information conveyed verbally or as found in: <ul style="list-style-type: none"> <li>• task lists</li> <li>• instructions</li> <li>• manufacturer manuals</li> <li>• diagrams and schematics</li> <li>• technical drawings and sketches</li> <li>• parts lists</li> <li>• computer records</li> </ul>
<b>Planning techniques and tools</b>	Scheduling, time management, brainstorming, setting goals and defined outcomes, prioritising, review and evaluation strategies

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	



## Competency field

Competency field	Planning
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# MEM14065A Plan and design aeronautical engineering projects

## Modification History

Not applicable.

## Unit Descriptor

This unit of competency covers systematically planning and designing within an aeronautical engineering context.

## Application of the Unit

Competency in this unit includes significant contribution to the planning, design and acceptance process for aeronautical engineering applications. Planning and design should be implemented systematically within the context of market or customer requirements and prevailing industrial environment, in accordance with planning and design parameters, such as performance, financial, legal, resource and scheduling.

Applications of planning and design in aeronautical engineering may include the conceptual development, management, design, manufacture, implementation, installation, commissioning and maintenance of aerospace structures, structural components, systems and system components for civil or military applications.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
MEA350A	Select and test aeronautical engineering materials
MEM14083A	Apply aeronautical engineering fundamentals to support design and development of projects
MEM16008A	Interact with computing technology

MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM23073A	Select and apply aeronautical engineering methods, processes and construction techniques
MEM23084A	Apply scientific principles and techniques in aeronautical engineering situations
MEM23095A	Apply aeronautical system design principles and techniques in engineering situations
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| 1 Research and report the context and parameters of the planning and design process for aeronautical engineering applications | 1.1 Research and report on the context and parameters of the planning and design process for aeronautical engineering applications   |
|   | 1.2 Identify and report on the market and industrial context and parameters of the planning and design process for a significant and particular aeronautical engineering application |
| 2 Interpret the brief and clarify client requirements   | 2.1 Interpret client requirements for an application in an engineering environment   |
|   | 2.2 Develop the design requirements and parameters with client   |
| 3 Prepare concept proposal  | 3.1 Generate a range of different, innovative and creative approaches to achieve design requirements   |
|   | 3.2 Check feasibility of a range of design solutions   |

- against design parameters
- 3.3 Assess opportunities for concurrent design activities
  - 3.4 Assess design solutions for conformity to occupational health and safety (OHS), environment and regulatory requirements
  - 3.5 Seek opinions of colleagues and a range of creative and technical experts/specialists
  - 3.6 Prepare plan and design concept proposal that includes results of feasibility study consideration of expert opinion, initial calculations and modelling and the use of judgment and discretion
  - 3.7 Review concept proposal with client to improve outcomes and overcome possible problems
- 4 Implement the planning and design process for particular applications
- 4.1 Select and manage resources and processes to develop the plan or design
  - 4.2 Document management processes
  - 4.3 Incorporate appropriate components and systems in the planning and design process
  - 4.4 Perform engineering activities and manage self to implement the planning and design process
  - 4.5 Apply appropriate calculations and assumptions in implementing the planning and design process
  - 4.6 Implement appropriate computing hardware and software and programming techniques in the planning and design process
  - 4.7 Apply appropriate scientific principles to implement planning and design process
  - 4.8 Implement appropriate materials properties knowledge in the planning and design process
  - 4.9 Implement appropriate engineering methods and processes knowledge in the planning and design process
  - 4.10 Ensure implementation is appropriate and efficiently carried out in the planning and design process

- |   |   |
|---|---|
| 5 Review the design and implementation plan | 5.1 Review the design and implementation plan to ensure conformity with current specification, contract and organisational procedures, OHS and regulatory standards, that it addresses feedback from stakeholders and meets client expectations<br><br>5.2 Achieve and document client acceptance of the design |
| 6 Maintain design documentation             | 6.1 Complete all design documentation in accordance with organisational requirements<br><br>6.2 Confirm planning charts are current, resource and costing records complete  |
| 7 Review design outcomes                    | 7.1 Review design outcomes in terms of the intended and actual use  |

## Required Skills and Knowledge

Required knowledge includes:

- context and parameters of the planning and design process for a comprehensive range of engineering applications
- market and industrial context and parameters, such as financial, legal, resource and scheduling of the planning and design process for a significant and particular engineering application the procedures for documenting and confirming client requirements
- client requirements
- appropriate codes, standards, specifications and legislative and regulatory requirements
- implications for sustainability and options for improved environmental outcomes
- issues of sustainability and environmental impact
- constraints and risks associated with the development and implementation of the design
- the scope of the design
- sources of information on standard and innovative or creative project solutions
- issues of sustainability, environmental and/or community impact
- design parameters or constraints
- process of analysis, comparison and contrasting
- sequential and concurrent design activities
- input and effects of advice from colleagues, experts and specialists
- features of concept proposal in the context of design brief, feasibility study and expert opinion
- concept proposal review process
- human and physical resources available to carry out the design task
- the most appropriate process to develop the plan and design to meet the agreed outcomes

and cost structure

- reasons for establishing and maintaining a document management process
- engineering fundamentals affecting selection of components and systems
- relevance of defined engineering activities to successful project completion and career enhancement
- reasons for using particular design approach, calculations and assumptions
- reasons for using particular hardware and software and programming technique
- reasons for considering or using particular scientific principles
- reasons for providing for particular materials properties knowledge in the implementation of the planning and design process
- reasons for providing for particular methods and processes in the implementation of the planning and design process
- graphical and documentary options
- rationale for graphics and documents raised in the context of application, project and contractual requirements
- reasons for use of elective competencies in the implementation of the planning and design process
- key aspects of the design and implementation plan in the context of current specification, contract and organisational procedures, OHS and regulatory standards
- effect of design team, expert input and client feedback on design and implementation plan
- procedures for gaining client endorsement and documenting client acceptance of the design solution and implementation plan
- significance of the document control process
- procedures for initiating and gaining approval for design changes
- procedures for updating issued documents
- appropriate tests and testing schedules to monitor the outcomes or performance of the project
- reasons for selecting the chosen tests and schedules
- variations in measured performance from design specifications
- corrective action to return the design outcome or project performance to specification

Required skills include:

- researching and reporting context and parameters of the planning and design process for a comprehensive range of engineering applications
- planning and designing a significant and particular engineering application within the market and industrial context and in conformance with project parameters, such as financial, legal, resource and scheduling
- documenting and confirming client requirements in accordance with organisational procedures and practices
- informing client of known OHS, regulatory, ethical, environmental, physical and cost limitations
- identifying design parameters
- establishing scope of design brief
- writing specifications to meet design requirements

- documenting and agreeing on acceptance criteria with the client
- reviewing different approaches of technical feasibility, innovation, creativity, and acceptance to client
- documenting possible design concepts
- analysing, comparing and contrasting the relative merits of possible design concepts
- documenting an objective analysis of each approach (e.g. weighted 'trade-off' table)
- organising design activities into sequential and concurrent design activities
- discussing proposals with colleagues and specialists
- clarifying creative and technical aspects of the proposals
- documenting concept proposal in accordance with organisational procedures
- establishing the design and planning team in accordance with organisational procedures
- identifying resources and establishing management procedures
- controlling documentation in accordance with established procedures
- selecting components and systems
- addressing professional indemnity and ethical issues
- negotiating, documenting and monitoring outcomes and performance measures
- developing work instructions
- monitoring and correcting project progress
- performing risk analysis and corrective action
- assumptions and calculations for implementation of the planning and design process
- preparing design diagrams and calculations
- applying scientific principles in the implementation of the planning and design process
- selecting materials
- selecting engineering methods and processes
- creating demonstration models
- confirming the design solution and plan
- authorising modifications to the engineering specification in accordance with organisational procedures
- incorporating corrections and improvements to the design
- applying OHS, environment and regulatory standards
- completing design documentation
- documenting changes to the design and implementation plan
- obtaining and reviewing feedback from the commissioning process
- monitoring the project outcomes or performance in the user's environment
- addressing deficiencies in project outcomes or performance as measured against current specifications

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to plan and design aeronautical engineering projects for a range of engineering applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning and design of aeronautical engineering projects or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	



## Range Statement

<b>Design process</b>	<p>Design process refers to:</p> <ul style="list-style-type: none"> <li>the consideration and identification of a problem or opportunity to improve an existing design. The conceptual process used to bring together innovation, aesthetics and functionality to plan and create an artefact, a product, a process or a system including programming and scheduling to meet an artistic or industrial requirement of an individual or group</li> </ul>
<b>Aeronautical engineering</b>	<p>Aeronautical engineering refers to:</p> <ul style="list-style-type: none"> <li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li> </ul>
<b>Parameters</b>	<p>Parameters may include:</p> <ul style="list-style-type: none"> <li>competitiveness</li> <li>performance</li> <li>financial</li> <li>legal</li> <li>resource</li> <li>scheduling</li> </ul>
<b>Concurrent design activities</b>	<p>Concurrent design activities refer to:</p> <ul style="list-style-type: none"> <li>the process of involvement of all stakeholders from initial planning and design to implementation and commissioning, and may include product or project data management system with graded access privileges</li> </ul>
<b>OHS and environment requirements</b>	<p>OHS and environment requirements recognise that stakeholders in workplace activities include the workforce exposed to worksite conditions, materials and processes of the activity and the broader community exposed to environmental effects of the activity. These apply in accordance with organisational policies and statutory and regulatory requirements</p>
<b>Regulatory requirements</b>	<p>Regulatory requirements may be specified in:</p> <ul style="list-style-type: none"> <li>Civil Aviation Regulations or Civil Aviation Safety Regulations</li> <li>Australian Defence Force AAP7001.053 Technical Airworthiness Maintenance Manual</li> <li>United States Federal Aviation Regulations</li> </ul>

	<ul style="list-style-type: none"><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>
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## Unit Sector(s)

Planning

## Custom Content Section

Not applicable.

# MEM14066A Plan and design avionic engineering projects

## Modification History

Not applicable.

## Unit Descriptor

This unit of competency covers systematically planning and designing within an avionic engineering context.

## Application of the Unit

Competency in this unit includes significant contribution to the planning, design, and approval process for avionic engineering applications. Planning and design should be implemented systematically within the context of market or customer requirements and prevailing industrial environment, in accordance with planning and design parameters, such as performance, financial, legal, resource and scheduling.

Applications of planning and design in avionic engineering may include the conceptual development, management, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components for civil or military applications.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
MEA273A	Select and test avionic engineering materials
MEM14084A	Apply avionic engineering fundamentals to support design and development of projects
MEM16008A	Interact with computing technology

MEM23074A	Select and apply avionic engineering methods, processes and construction techniques
MEM23085A	Apply scientific principles and techniques in avionic engineering situations
MEM23096A	Apply avionic system design principles and techniques in engineering situations
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |  |  |
|--|--|
| 1 Research and report the context and parameters of the planning and design process for avionic engineering applications | 1.1 Research and report on the context and parameters of the planning and design process for avionic engineering applications<br><br>1.2 Identify and report on the market and industrial context and parameters of the planning and design process for a significant and particular avionic engineering application |
| 2 Interpret the brief and clarify client requirements  | 2.1 Interpret client requirements for an application in an engineering environment<br><br>2.2 Develop the design requirements and parameters with client   |
| 3 Prepare concept proposal   | 3.1 Generate a range of different, innovative and creative approaches to achieve design requirements<br><br>3.2 Check feasibility of a range of design solutions against design parameters<br><br>3.3 Assess opportunities for concurrent design activities  |

- 3.4 Assess design solutions for conformity to occupational health and safety (OHS), environment and regulatory requirements
- 3.5 Seek opinions of colleagues and a range of creative and technical experts/specialists
- 3.6 Prepare plan and design concept proposal that includes results of feasibility study consideration of expert opinion, initial calculations and modelling and the use of judgment and discretion
- 3.7 Review concept proposal with client to improve outcomes and overcome possible problems
- 4 Implement the planning and design process for particular applications
  - 4.1 Select and manage resources and processes to develop the plan or design
  - 4.2 Document management processes
  - 4.3 Incorporate appropriate components and systems in the planning and design process
  - 4.4 Perform engineering activities and manage self to implement the planning and design process
  - 4.5 Apply appropriate calculations and assumptions in implementing the planning and design process
  - 4.6 Implement appropriate computing hardware and software and programming techniques in the planning and design process
  - 4.7 Apply appropriate scientific principles to implement planning and design process
  - 4.8 Implement appropriate materials properties knowledge in the planning and design process
  - 4.9 Implement appropriate engineering methods and processes knowledge in the planning and design process
  - 4.10 Ensure implementation is appropriate and efficiently carried out in the planning and design process
- 5 Review the design and implementation plan
  - 5.1 Review the design and implementation plan to ensure conformity with current specification, contract and organisational procedures, OHS and regulatory standards, that it addresses feedback from

stakeholders and meets client expectation

5.2 Achieve and document client acceptance of the design

6 Maintain design documentation 6.1 Complete all design documentation in accordance with organisational requirements

6.2 Ensure planning charts are current, resource and costing records complete

7 Review design outcomes 7.1 Review design outcomes in terms of the intended and actual use

## Required Skills and Knowledge

Required knowledge includes:

- context and parameters of the planning and design process for a comprehensive range of engineering applications
- market and industrial context and parameters, such as financial, legal, resource and scheduling of the planning and design process for a significant and particular engineering application
- procedures for documenting and confirming client requirements
- client requirements
- appropriate codes, standards, specifications and legislative and regulatory requirements
- implications for sustainability and options for improved environmental outcomes
- issues of sustainability and environmental impact were examined
- constraints and risks associated with the development and implementation of the design
- the scope of the design
- sources of information on standard and innovative or creative project solutions
- issues of sustainability, environmental and/or community impact
- design parameters or constraints
- process of analysis, comparison and contrasting
- sequential and concurrent design activities
- input and effects of advice from colleagues, experts and specialists
- features of concept proposal in the context of design brief, feasibility study and expert opinion
- concept proposal review process
- human and physical resources available to carry out the design task
- the most appropriate process to develop the plan and design to meet the agreed outcomes and cost structure
- reasons for establishing and maintaining a document management process

- engineering fundamentals affecting selection of components and systems
- relevance of defined engineering activities to successful project completion and career enhancement
- reasons for using particular design approach, calculations and assumptions
- reasons for using particular hardware and software and programming technique
- reasons for considering or using particular scientific principles
- reasons for providing for particular materials properties knowledge in the implementation of the planning and design process
- reasons for providing for particular methods and processes in the implementation of the planning and design process
- graphical and documentary options
- rationale for graphics and documents raised in the context of application, project and contractual requirements
- reasons for use of elective competencies in the implementation of the planning and design process
- key aspects of the design and implementation plan in the context of current specification, contract and organisational procedures, OHS and regulatory standards
- effect of design team, expert input and client feedback on design and implementation plan
- procedures for gaining client endorsement and documenting client acceptance of the design solution and implementation plan
- significance of the document control process
- procedures for initiating and gaining approval for design changes
- procedures for updating issued documents
- appropriate tests and testing schedules to monitor the outcomes or performance of the project
- reasons for selecting the chosen tests and schedules
- variations in measured performance from design specifications
- corrective action to return the design outcome or project performance to specification

Required skills include:

- researching and reporting context and parameters of the planning and design process for a comprehensive range of engineering applications
- planning and designing a significant and particular engineering application within the market and industrial context and in conformance with project parameters, such as financial, legal, resource and scheduling
- documenting and confirming client requirements in accordance with organisational procedures and practices
- informing client of known OHS, regulatory, ethical, environmental, physical and cost limitations
- identifying design parameters
- establishing scope of design brief
- writing specifications to meet design requirements
- documenting and agreeing on acceptance criteria with the client
- reviewing different approaches of technical feasibility, innovation, creativity, and

acceptance to client

- documenting possible design concepts
- analysing, comparing and contrasting the relative merits of possible design concepts
- documenting an objective analysis of each approach (e.g. weighted 'trade-off' table)
- organising design activities into sequential and concurrent design activities
- discussing proposals with colleagues and specialists
- clarifying creative and technical aspects of the proposals
- documenting concept proposal in accordance with organisational procedures
- establishing the design and planning team in accordance with organisational procedures
- identifying resources and establishing management procedures
- controlling documentation in accordance with established procedures
- selecting components and systems
- addressing professional indemnity and ethical issues
- negotiating, documenting and monitoring outcomes and performance measures
- developing work instructions
- monitoring and correcting project progress
- performing risk analysis and corrective action
- assumptions and calculations for implementation of the planning and design process
- preparing design diagrams and calculations
- applying scientific principles in the implementation of the planning and design process
- selecting materials
- selecting engineering methods and processes
- creating demonstration models
- confirming the design solution and plan
- authorising modifications to the engineering specification in accordance with organisational procedures
- incorporating corrections and improvements to the design into the revised design solution and plan
- applying OHS, environment and regulatory standards
- completing design documentation
- documenting changes to the design and implementation plan
- obtaining and reviewing feedback from the commissioning process
- monitoring the project outcomes or performance in the user's environment
- addressing deficiencies in project outcomes or performance as measured against current specifications



## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to plan and design avionic engineering projects for a range of engineering applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with planning and design of aeronautical engineering projects or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Design process</b>	<p>Design process refers to:</p> <ul style="list-style-type: none"> <li>the consideration and identification of a problem or opportunity to improve an existing design. The conceptual process used to bring together innovation, aesthetics and functionality to plan and create an artefact, a product, a process or a system including programming and scheduling to meet an artistic or industrial requirement of an individual or group</li> </ul>
<b>Avionic engineering</b>	<p>Avionic engineering refers to:</p> <ul style="list-style-type: none"> <li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li> </ul>
<b>Parameters</b>	<p>Parameters may include:</p> <ul style="list-style-type: none"> <li>competitiveness</li> <li>performance</li> <li>financial</li> <li>legal</li> <li>resource</li> <li>scheduling</li> </ul>
<b>Concurrent design activities</b>	<p>Concurrent design activities refers to:</p> <ul style="list-style-type: none"> <li>the process of involvement of all stakeholders from initial planning and design to implementation and commissioning, and may include product or project data management system with graded access privileges</li> </ul>
<b>OHS and environment requirements</b>	<p>OHS and environment requirements recognise that stakeholders in workplace activities include the workforce exposed to worksite conditions, materials and processes of the activity and the broader community exposed to environmental effects of the activity. These apply in accordance with organisational policies and statutory and regulatory requirements</p>
<b>Regulatory requirements</b>	<p>Regulatory requirements may be specified in:</p> <ul style="list-style-type: none"> <li>Civil Aviation Regulations or Civil Aviation Safety Regulations</li> <li>Australian Defence Force AAP7001.053 Technical Airworthiness Maintenance Manual</li> <li>United States Federal Aviation Regulations</li> </ul>

	<ul style="list-style-type: none"><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>
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## Unit Sector(s)

Planning

## Custom Content Section

Not applicable.

## **MEM14083A Apply aeronautical engineering fundamentals to support design/development of engineering projects**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers engineering fundamentals required to support aerospace mechanical and manufacturing product, process, system or service design, development and improvement.

Control, data collection and supervisory systems are selected and implemented with technical assistance.

### **Application of the Unit**

Competency in this unit requires significant application of aerospace aeronautical engineering fundamentals in support of engineering product, process, system or service design, development or improvement.

Control, data collection and supervisory systems may be selected and implemented with technical assistance.

The candidate should provide significant support to the design and development process as a member of a design and development or engineering support team.

Design, development and improvement activities apply to selection and implementation of human resources, software, test equipment, materials, components and systems, support structures, power supply and control, data collection and supervisory systems (with technical support).

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
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MEM16008A	Interact with computing technology
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| <p>1 Research, evaluate and support implementation and report on designing and development processes within an industrial context</p> | <p>1.1 Research and evaluate applications for problem solving, implementation and improvement processes, philosophies and techniques, including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, total quality management (TQM) and tools of TQM</p> |
|   | <p>1.2 Support implementation and report on engineering projects incorporating problem solving, improvement processes, philosophies and techniques</p>   |
|   | <p>1.3 Research, evaluate and report on case studies involving production processes</p>  |
| <p>2 Identify resources, skills, knowledge and techniques required by engineering applications</p>                                    | <p>2.1 Identify resources, skills, knowledge and techniques for engineering applications</p>   |
|   | <p>2.2 With the help of others, identify control and supervisory systems if required by particular applications</p>  |
|   | <p>2.3 Identify functional attributes of components and systems of aeronautical engineering projects</p>   |
| <p>3 Identify and use sources of information on resources, skills</p>   | <p>3.1 Identify and use appropriate sources of information on resources, skills, knowledge and techniques for</p>  |

and knowledge for engineering projects	engineering projects
	3.2 Use trade language and descriptions of resources and techniques as appropriate
	3.3 Implement appropriate computing techniques in the process of sourcing, categorising, cataloguing and reporting on resources search results for engineering applications
4 Apply engineering fundamentals in support of selection of resources for engineering applications	4.1 Apply appropriate basic scientific principles and techniques in support of selection of resources for engineering applications
	4.2 Use appropriate calculations and assumptions to enable choices of resources for engineering applications
	4.3 Apply appropriate materials properties, methods and processes knowledge in support of selection of resources for engineering applications
	4.4 Select appropriate resources for the engineering application based on functional or performance specification of system and components of application
5 Specify resources, and technical support requirements	5.1 Specify resources and technical support for engineering applications sufficient to facilitate their identification and supply
	5.2 Identify suppliers of resources and technical support
6 Assist with design specifications and development procedures for engineering applications	6.1 Contribute significantly to the creation of design, implementation, installation, commissioning and maintenance procedures, and documents for specific engineering applications
	6.2 Implement appropriate computing and programming techniques in the process of development of design specifications and documentation for specific engineering applications
	6.3 Create and file design graphics and documentation suitable to the design and development process of the application or project in accordance with organisational and contractual requirements
7 Assist with implementation of	7.1 Assist significantly with implementation of design, development, installation, commissioning and

design and development

maintenance in accordance with regulatory requirements, specifications and documentation for specific aeronautical engineering applications

8 Review and report on design implementation

8.1 Review design implementation

8.2 Report on and record results of design, investigation, selection, specification and implementation, installation, commissioning and maintenance processes

## Required Skills and Knowledge

Required knowledge includes:

- problem solving, implementation and improvement processes, philosophies and techniques, including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, TQM and tools of TQM
- implementation of specific aeronautical engineering projects incorporating problem solving, improvement processes, philosophies and techniques, including ILS
- continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, JIT, and competitive (lean) manufacturing
- implementation of specific aeronautical engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, JIT, competitive (lean) manufacturing, design for reliability, optimum maintenance and computer-managed maintenance
- significance and characteristics of software, test and analysis equipment, materials, components and systems, support structures, power supply, methods and processes, principles and techniques, control and supervisory systems to the application can be explained
- functional attributes of resources
- relationship of essential attributes to application function
- classification of attributes as essential versus desirable
- the value of desirable attributes
- methods of accessing and using alternative information sources
- appropriate sources of information
- trade language and descriptions
- reasons for using particular hardware and software
- methods of using hardware and software
- reasons for using particular scientific principles
- reasons for using particular calculations and assumptions
- reasons for providing for particular materials properties in the engineering application
- reasons for selecting resources with reference to functional or performance specification of system and components of application

- trade language descriptions used in specification
- procedural steps for implementation, commissioning and maintenance purposes
- graphical and documentary options
- rationale for graphics and documents raised can be explained in the context of application, project and contractual requirements
- implementation of design, development, installation, commissioning and maintenance procedures in the context of the specific application
- installation, programming, commissioning and maintenance of computer and control hardware and software in the context of the specific application
- design implementation review procedures

Required skills include:

- researching, evaluating and implementing specific aeronautical engineering projects using integrated logistic support (ILS) processes that may encompass problem solving, implementation and improvement processes, philosophies and techniques, including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, TQM and tools of TQM
- researching, evaluating and implementing specific aeronautical engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, just in time (JIT), competitive (lean) manufacturing, design for reliability, optimum maintenance and computer-managed maintenance
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate to particular engineering applications
- identifying functional attributes of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- identifying essential attributes and desirable attributes in preparation for investigation, research and sourcing
- establishing provision for control systems from expert advice
- using computer hardware and software for gathering and analysing information
- applying scientific principles in the choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- making assumptions and calculations to justify choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- selecting materials properties for the engineering application
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate for the engineering application
- using relevant trade language
- specifying appropriate technical support
- specifying implementation, installation, commissioning and maintenance documentation and procedures
- providing for control system requirements
- using computer hardware and software and effectively in the design and development process of the engineering applications
- preparing design graphics and documentation to satisfy application and contractual



requirements

- giving feedback on variations
- ensuring provision for control systems
- completing reports, records and design documentation

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply aeronautical engineering fundamentals to support design and development of projects for a range of engineering applications and within the application of ILS. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying aeronautical engineering fundamentals to support design and development of projects or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	



## Range Statement

<b>Kaizen</b>	<p>Kaizen, as applied to engineering refers to:</p> <ul style="list-style-type: none"> <li>gradual and continual improvement to products, processes, systems and services</li> </ul>
<b>TQM</b>	<p>TQM refers to:</p> <ul style="list-style-type: none"> <li>a customer driven amalgamation of quality assurance, quality control and quality improvement which in aeronautical engineering may be applied as part of ILS</li> </ul>
<b>Tools of TQM</b>	<p>Tools of TQM include:</p> <ul style="list-style-type: none"> <li>flow charts</li> <li>Pareto</li> <li>Ishikawa (cause and effect)</li> <li>process capability analysis</li> <li>sampling and control charting</li> <li>run charts</li> <li>correlation analysis</li> </ul>
<b>Production processes may include</b>	<p>Production processes may include:</p> <ul style="list-style-type: none"> <li>continuous, mass, batch, jobbing or prototype</li> <li>competitive (lean) manufacturing, including sequential and cellular manufacture and assembly, JIT, design for reliability, optimum maintenance, and computer-managed maintenance</li> </ul>
<b>Competitive (lean) manufacturing principles and techniques</b>	<p>Competitive (lean) manufacturing principles and techniques includes:</p> <ul style="list-style-type: none"> <li>sequential and cellular manufacture and assembly with multi-skilling of work teams, workplace improvement, TQM, including use of TQM tools, JIT, quick changeover, process and productivity improvement, cost reduction, supply and demand chain management, quality optimisation, design for reliability, optimum maintenance, and computer-managed maintenance</li> </ul>
<b>Resources, skills, knowledge and techniques for engineering applications</b>	<p>Resources, skills, knowledge and techniques for engineering applications may include:</p> <ul style="list-style-type: none"> <li>human resources</li> <li>software</li> <li>test and analysis equipment</li> <li>materials, components and systems</li> <li>support structures</li> <li>power supply</li> <li>methods and processes</li> </ul>

	<ul style="list-style-type: none"><li>• principles and techniques</li><li>• control, data collection and supervisory systems</li></ul> Techniques include those required to: <ul style="list-style-type: none"><li>• select, manufacture, install, commission, test and maintain components and systems</li></ul>
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<b>Components and systems</b>	<p>Components and systems include:</p> <ul style="list-style-type: none"> <li>• aircraft structure and structural components</li> <li>• mechanical systems and components</li> <li>• hydraulic systems and components</li> <li>• pneumatic systems and components</li> <li>• fuel systems and components</li> <li>• fire systems and components</li> <li>• power plant systems and components, and the interface between hydro-mechanical, pneumatic and power plant systems and avionic systems, including automatic flight control, flight management, pressurisation and air conditioning systems and engine management systems</li> </ul>
<b>Aeronautical engineering</b>	<p>Aeronautical engineering refers to:</p> <ul style="list-style-type: none"> <li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li> </ul>
<b>Sources of information</b>	<p>Sources of information may include:</p> <ul style="list-style-type: none"> <li>• manufacturer catalogues</li> <li>• websites</li> <li>• texts and technical journals</li> <li>• use of phone, email and fax information gathering</li> </ul> <p>Information sought includes:</p> <ul style="list-style-type: none"> <li>• human resources</li> <li>• software, test and analysis equipment</li> <li>• materials, components and systems</li> <li>• support structures, power supply, methods and processes</li> <li>• principles and techniques</li> <li>• control and supervisory systems</li> </ul>
<b>Implementation process</b>	<p>Implementation process may include:</p> <ul style="list-style-type: none"> <li>• monitor failure patterns and modes</li> <li>• develop/document revisions to maintenance schedules</li> <li>• develop or revise test and maintenance procedures, including associated software</li> <li>• propose amendments to test and maintenance procedures</li> <li>• develop and propose modifications to improve</li> </ul>

	<p>performance and/or reliability</p> <ul style="list-style-type: none"><li>• elimination of electromagnetic interference</li></ul>
<b>Regulatory requirements may be specified in</b>	<p>Regulatory requirements may be specified in:</p> <ul style="list-style-type: none"><li>• Civil Aviation Regulations or Civil Aviation Safety Regulations</li><li>• Australian Defence Force AAP7001.053 Technical Airworthiness Maintenance Manual</li><li>• United States Federal Aviation Regulations</li><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>

## Unit Sector(s)

Planning

## Custom Content Section

Not applicable.

## **MEM14084A Apply avionic engineering fundamentals to support design and development of engineering projects**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers engineering fundamentals required to support avionic and manufacturing product, process, system or service design, development and improvement. Control, data collection and supervisory systems are selected and implemented with technical assistance.

### **Application of the Unit**

Competency in this unit requires significant application of aerospace avionic engineering fundamentals in support of engineering product, process, system or service design, development or improvement.

Control, data collection and supervisory systems may be selected and implemented with technical assistance and within the application of integrated logistic support (ILS).

The candidate should provide significant support to the design and development process as a member of a design and development or engineering support team.

Design, development and improvement activities apply to selection and implementation of human resources, software, test equipment, materials, components and systems, support structures, power supply and control, data collection and supervisory systems (with technical support).

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
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MEM16008A	Interact with computing technology
MEM30012A	Apply mathematical techniques in manufacturing, engineering or related situations

## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Research, evaluate and support implementation and report on designing and development processes within an industrial context | 1.1 Research and evaluate applications for problem solving, implementation and improvement processes, philosophies and techniques, including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, total quality management (TQM) and tools of TQM |
|  | 1.2 Support implementation and report on engineering projects incorporating problem solving, improvement processes, philosophies and techniques   |
|  | 1.3 Research, evaluate and report on case studies involving production processes  |
| 2 Identify resources, skills, knowledge and techniques required by engineering applications                                    | 2.1 Identify resources, skills, knowledge and techniques for engineering applications   |
|  | 2.2 With the help of others, identify control and supervisory systems if required by particular applications  |
|  | 2.3 Identify functional attributes of components and systems of avionic engineering projects  |
| 3 Identify and use sources of information on resources, skills and knowledge for engineering projects                          | 3.1 Identify and use appropriate sources of information on resources, skills, knowledge and techniques for engineering projects   |
|  | 3.2 Use trade language and descriptions of resources and  |

- techniques as appropriate
- 3.3 Implement appropriate computing techniques in the process of sourcing, categorising, cataloguing and reporting on resources search results for engineering applications
- 4 Apply engineering fundamentals in support of selection of resources for engineering applications
- 4.1 Apply appropriate basic scientific principles and techniques in support of selection of resources for engineering applications
- 4.2 Use appropriate calculations and assumptions to enable choices of resources for engineering applications
- 4.3 Apply appropriate materials properties, methods and processes knowledge in support of selection of resources for engineering applications
- 4.4 Select appropriate resources for the engineering application based on functional or performance specification of system and components of application
- 5 Specify resources, and technical support for engineering applications
- 5.1 Specify resources, and technical support for engineering applications sufficient to facilitate their identification and supply
- 5.2 Identify suppliers of resources and technical support
- 6 Assist with design specifications and development procedures for engineering applications
- 6.1 Contribute significantly to the creation of design, implementation, installation, commissioning and maintenance procedures and documents for specific engineering applications
- 6.2 Implement appropriate computing and programming techniques in the process of development of design specifications and documentation for specific engineering applications
- 6.3 Create and file design graphics and documentation suitable to the design and development process of the application or project in accordance with organisational and contractual requirements
- 7 Assist with implementation of design and development
- 7.1 Assist significantly with implementation of design, development, installation, commissioning and maintenance in accordance with regulatory requirements, specifications and documentation for

specific avionic engineering applications

8 Review and report on design implementation

8.1 Review design implementation

8.2 Report on and record results of design, investigation, selection, specification and implementation, installation, commissioning and maintenance processes

## Required Skills and Knowledge

Required knowledge includes:

- problem solving, implementation and improvement processes, philosophies and techniques including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, TQM and tools of TQM
- implementation of specific avionic engineering projects incorporating problem solving, improvement processes, philosophies and techniques, including ILS
- continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, JIT, and competitive (lean) manufacturing
- implementation of specific avionic engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, JIT, competitive (lean) manufacturing, design for reliability, optimum maintenance and computer-managed maintenance
- significance and characteristics of software, test and analysis equipment, materials, components and systems, support structures, power supply, methods and processes, principles and techniques, control and supervisory systems to the application can be explained
- functional attributes of resources
- relationship of essential attributes to application function
- classification of attributes as essential versus desirable
- the value of desirable attributes
- methods of accessing and using alternative information sources
- appropriate sources of information
- trade language and descriptions
- reasons for using particular hardware and software
- methods of using hardware and software
- avoidance of electromagnetic interference problems
- the reasons for using particular scientific principles
- reasons for using particular calculations and assumptions
- reasons for providing for particular materials properties in the engineering application
- reasons for selecting resources with reference to functional or performance specification of system and components of application

- trade language descriptions used in specification
- procedural steps for implementation, commissioning and maintenance purposes
- graphical and documentary options
- rationale for graphics and documents raised can be explained in the context of application, project and contractual requirements
- implementation of design, development, installation, commissioning and maintenance procedures in the context of the specific application
- installation, programming, commissioning and maintenance of computer and control hardware and software in the context of the specific application
- design implementation review procedures

Required skills include:

- researching, evaluating and implementing f specific avionic engineering projects using ILS processes that may encompass problem solving, implementation and improvement processes, philosophies and techniques including problem solving, brainstorming, decision-tree, trade-off tables, Kaizen, TQM and tools of TQM
- researching, evaluating and implementing specific avionic engineering projects within continuous, mass, batch, jobbing or prototype production processes, sequential and cellular manufacture and assembly, just in time (JIT), competitive (lean) manufacturing, design for reliability, optimum maintenance and computer-managed maintenance
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate to particular engineering applications
- identifying functional attributes of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- identifying essential attributes and desirable attributes in preparation for investigation, research and sourcing
- establishing provision for control systems from expert advice
- using computer hardware and software for gathering and analysing information
- applying scientific principles in the choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- making assumptions and calculations to justify choice of test and analysis equipment, materials, components and systems, support structures, power supply and control systems
- selecting materials properties for the engineering application
- selecting test and analysis equipment, materials, components and systems, support structures, power supply and control systems appropriate for the engineering application
- using relevant trade language
- specifying appropriate technical support
- specifying implementation, installation, commissioning and maintenance documentation and procedures
- providing for control system requirements
- using computer hardware and software and effectively in the design and development process of the engineering applications
- preparing design graphics and documentation to satisfy application and contractual requirements

- giving feedback on variations
- ensuring provision for control systems
- completing reports, records and design documentation

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply avionic engineering fundamentals to support design and development of projects for a range of engineering applications and within the application of ILS. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying avionic engineering fundamentals to support design and development of projects or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	



## Range Statement

<b>Kaizen</b>	<p>Kaizen, as applied to engineering refers to:</p> <ul style="list-style-type: none"> <li>gradual and continual improvement to products, processes, systems and services</li> </ul>
<b>TQM</b>	<p>TQM refers to:</p> <ul style="list-style-type: none"> <li>a customer driven amalgamation of quality assurance, quality control and quality improvement which in aeronautical engineering may be applied as part of ILS</li> </ul>
<b>Tools of TQM</b>	<p>Tools of TQM include:</p> <ul style="list-style-type: none"> <li>flow charts</li> <li>Pareto</li> <li>Ishikawa (cause and effect)</li> <li>process capability analysis</li> <li>sampling and control charting</li> <li>run charts</li> <li>correlation analysis</li> </ul>
<b>Production processes may include</b>	<p>Production processes may include:</p> <ul style="list-style-type: none"> <li>continuous, mass, batch, jobbing or prototype</li> <li>competitive (lean) manufacturing, including sequential and cellular manufacture and assembly, JIT, design for reliability, optimum maintenance, and computer-managed maintenance</li> </ul>
<b>Competitive (lean) manufacturing principles and techniques</b>	<p>Competitive (lean) manufacturing principles and techniques includes:</p> <ul style="list-style-type: none"> <li>sequential and cellular manufacture and assembly with multi-skilling of work teams, workplace improvement, TQM, including use of TQM tools, JIT, quick changeover, process and productivity improvement, cost reduction, supply and demand chain management, quality optimisation, design for reliability, optimum maintenance, and computer-managed maintenance</li> </ul>
<b>Resources, skills, knowledge and techniques for engineering applications</b>	<p>Resources, skills, knowledge and techniques for engineering applications may include:</p> <ul style="list-style-type: none"> <li>human resources</li> <li>software</li> <li>test and analysis equipment</li> <li>materials, components and systems</li> <li>support structures</li> <li>power supply</li> <li>methods and processes</li> </ul>



	<ul style="list-style-type: none"><li>• principles and techniques</li><li>• control, data collection and supervisory systems</li></ul> Techniques include those required to: <ul style="list-style-type: none"><li>• select, manufacture, install, commission, test and maintain components and systems</li></ul>
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<b>Components and systems</b>	<p>Components and systems include:</p> <ul style="list-style-type: none"> <li>• electrical systems and related wiring and components (power generation, distribution, control interfaces with hydraulic and pneumatic systems, and caution and warning systems)</li> <li>• mechanical and electro-mechanical flight instruments and indication systems (quantity, pressure, temperature, position) and components, automatic pilot systems, electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management, and engine management), and automatic test stations, adapters and software</li> </ul>
<b>Avionic engineering</b>	<p>Avionic engineering refers to:</p> <ul style="list-style-type: none"> <li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li> </ul>
<b>Sources of information</b>	<p>Sources of information may include:</p> <ul style="list-style-type: none"> <li>• manufacturer catalogues</li> <li>• websites</li> <li>• texts and technical journals</li> <li>• use of phone, email and fax information gathering</li> </ul> <p>Information sought includes:</p> <ul style="list-style-type: none"> <li>• human resources</li> <li>• software, test and analysis equipment</li> <li>• materials, components and systems</li> <li>• support structures, power supply, methods and processes</li> <li>• principles and techniques</li> <li>• control and supervisory systems</li> </ul>
<b>Implementation process</b>	<p>Implementation process may include:</p> <ul style="list-style-type: none"> <li>• monitor failure patterns and modes</li> <li>• develop/document revisions to maintenance schedules</li> <li>• investigate, develop and implement maintenance test procedures</li> <li>• revise test and maintenance procedures, including associated software</li> <li>• propose amendments to test and maintenance</li> </ul>

	<p>procedures</p> <ul style="list-style-type: none"><li>• develop and propose modifications to improve performance and/or reliability</li><li>• establish weight and balance effect of modifications</li><li>• ensure electromagnetic interference requirements are met</li></ul>
<b>Regulatory requirements</b>	<p>Regulatory requirements may be specified in:</p> <ul style="list-style-type: none"><li>• Civil Aviation Regulations or Civil Aviation Safety Regulations</li><li>• Australian Defence Force AAP7001.053 Technical Airworthiness Maintenance Manual</li><li>• United States Federal Aviation Regulations</li><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>

## Unit Sector(s)

Planning

## Custom Content Section

Not applicable.

# **MEM14085A Apply mechanical engineering analysis techniques**

## **Modification History**

Release 1 - New unit Replaces MEM14061A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills needed to undertake a range of mechanical engineering-related analyses. The analyses may relate to design, fitness for purpose evaluations, installation and commissioning, and other mechanical engineering-related tasks. Documentation of the design process includes calculations, specifications, computer-aided design (CAD) files, risk analysis, sustainability and life cycle assessments.

## **Application of the Unit**

This unit applies to mechanical engineering analyses undertaken as part of a mechanical design or mechanical assessment of plant, products, projects, system changes or improvements. It is suitable for people working as mechanical designers and draftspersons and those pursuing careers and qualifications in mechanical engineering or related disciplines. The work may be undertaken individually or as part of a team.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential                      Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Investigate mechanical analysis context and need	1.1	Review the context and negotiate parameters of the mechanical design or task in consultation with stakeholders
		1.2	Identify relevant engineering scientific principles and required analysis techniques
		1.3	Investigate life cycle design and sustainability implications of mechanical design or existing plant or equipment
		1.4	Determine specification, documentation and graphical techniques required for analysis
		1.5	Confirm work health and safety (WHS) and regulatory requirements, codes of practice, standards, and risk management relevant to mechanical analysis task
		1.6	Determine available sources for any required technical and professional assistance
2	Apply mechanical analysis techniques	2.1	Plan, schedule and coordinate the analysis task
		2.2	Create adequate and accurate calculations, preliminary graphics and maintain analysis process records
		2.3	Evaluate multiple solutions against analysis criteria
		2.4	Apply systems thinking to problem solving and decision making
		2.5	Incorporate professional and technical assistance, as required
		2.6	Apply specification, documentation and graphical techniques modelling, mock-up or prototyping techniques, where required, to achieve or test solution

- |   |                |     |  |
|---|----------------|-----|--|
| 3 | Report results | 3.1 | Record results of analysis   |
|   |                | 3.2 | Provide documentation, such as calculations, specifications, diagrams, CAD files, mock-ups or prototypes |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating and negotiating with stakeholders and team
- determining or confirming relevance of mechanical engineering scientific principles and analysis techniques, including principles of:
  - mechanics
  - fluid power
  - fluid dynamics
  - thermodynamics
  - electrical fundamentals
  - engineering materials, properties and processes
- evaluating WHS and regulatory requirements, standards and codes of practice for relevance to analysis tasks
- evaluating multiple solutions against analysis criteria, risk, sustainability and cost factors
- applying life cycle design and sustainability parameters to analysis task
- planning, scheduling and coordinating the analysis task
- applying problem solving and decision making with systems thinking for contingencies and constraints and continuous improvement
- specifying, documenting and applying graphical techniques, including modelling
- undertaking or supervising mock-up or prototyping techniques, where required, to achieve solution
- creating and maintaining adequate and accurate calculations and analysis process records
- reporting and documenting results of investigations, application of principles and techniques, calculations, specifications, diagrams, CAD files, mock-ups or prototypes of designs

### Required knowledge

Required knowledge includes:

- implications of life cycle design, fitness for purpose evaluation and sustainability for mechanical analysis process
- mechanical engineering-related analysis processes and techniques to investigate, synthesise and develop proposals, evaluate feasibility against analysis criteria, and review and revise in consultation with stakeholders and team or support functional group
- common model, mock-up and prototyping techniques relevant to mechanical engineering
- systems thinking, problem solving and decision making, and continuous improvement methods
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- procedures for planning, scheduling and coordination of analysis
- hardware requirements of typical mechanical, fluid power, hydrodynamic and thermal applications
- engineering scientific principles required for design analysis:
  - mechanical
  - fluid power
  - fluid dynamics
  - thermodynamics
  - electrical fundamentals
  - engineering materials, properties and processes
- mechanical analysis calculation techniques
- software for product planning and analysis, such as CAD, stress analysis and mould design, and project management
- documentation and required information
- prototyping options, including mock-ups, physical and virtual modelling, and rapid prototyping

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply mechanical analysis techniques consistent with an analysis brief information, relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• communicate, negotiate and review analysis brief and</li></ul>

<b>competency in this unit</b>	<p>specification requirements with stakeholders</p> <ul style="list-style-type: none"> <li>• determine or confirm relevant scientific principles and analysis techniques, WHS and regulatory requirements</li> <li>• evaluate multiple solutions</li> <li>• investigate life cycle analysis and sustainability</li> <li>• plan, schedule and coordinate the analysis task</li> <li>• solve problems and make decisions with systems thinking for contingencies and constraints and continuous improvement</li> <li>• define analysis, specify and document and apply graphical techniques, modelling, mock-up or prototyping techniques</li> <li>• create and maintain adequate and accurate calculations and analysis process records</li> <li>• report and document, results and processes.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information</b>	Assessment processes and techniques must be culturally



<b>for assessment</b>	appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Mechanical engineering analysis</b>	<p>Mechanical engineering analysis may be required for a variety of reasons, including:</p> <ul style="list-style-type: none"> <li>• design of mechanical devices and plant</li> <li>• design or evaluation of significant modifications, process changes or improvements</li> <li>• sustainability issues relevant to plant, equipment or processes</li> <li>• static and dynamic analysis of loads, including the resulting stresses and deformations</li> <li>• fitness for purpose evaluation</li> <li>• installation and commissioning of plant and equipment</li> </ul>
<b>Planning processes</b>	<p>Planning processes may include:</p> <ul style="list-style-type: none"> <li>• establishing analysis parameters and criteria</li> <li>• contributing to the negotiation and advice process</li> <li>• preliminary planning, analysis investigations and costing</li> <li>• identifying analysis, development, prototyping activities and skills requirements</li> <li>• planning and scheduling analysis activities</li> <li>• improving, adjusting and rescheduling as required by emergency contingencies and constraints</li> </ul>
<b>Analysis process</b>	<p>Analysis as a systematic process includes:</p> <ul style="list-style-type: none"> <li>• establish analysis parameters and criteria</li> <li>• research, measurement, experimentation, and investigation</li> <li>• generating ideas</li> <li>• synthesis, problem solving and decision making, and addressing constraints</li> <li>• apply scientific principles, calculation and graphics, prototyping and mock-up techniques</li> <li>• evaluating solutions against analysis criteria</li> <li>• consultation, adjustments and agreement</li> </ul>

	<ul style="list-style-type: none"> <li>• finalise analysis and sign-off</li> </ul>
<b>Analysis criteria</b>	<p>Analysis includes relevant technical criteria and may also include criteria relating to:</p> <ul style="list-style-type: none"> <li>• function</li> <li>• manufacturability and maintainability</li> <li>• marketability</li> <li>• sustainability</li> <li>• cost constraints</li> <li>• ergonomics and anthropometrics and physiology</li> <li>• facilities, plant and skills available</li> <li>• contingencies and constraints minimisation</li> <li>• safety and risk</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Life cycle analysis</b>	<p>Life cycle analysis can be used to improve sustainability of products and services. It may be applied to:</p> <ul style="list-style-type: none"> <li>• all aspects of manufacture of a single product</li> <li>• the entire operations of an organisation</li> <li>• a particular aspect of operations, such as environmental implications</li> </ul>
<b>Prototyping</b>	<p>Prototyping may include:</p> <ul style="list-style-type: none"> <li>• mock-ups</li> <li>• physical and virtual modelling with post-processing for computer numeric control (CNC) and rapid prototyping</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect outcomes. Systems should</p>

	be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic danger, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to the mechanical engineering analysis task

## Unit Sector(s)

### Competency field

**Unit sector** Planning

## Custom Content Section

Not applicable.

# MEM14086A Apply mechatronic engineering analysis techniques

## Modification History

Release 1 - New unit. Replaces MEM14062A, but not equivalent.

## Unit Descriptor

This unit of competency covers the skills needed to undertake a range of mechatronic analyses. The analyses may relate to design or contribution to the design of mechatronic devices or automated plant or be for other purposes, including fitness for purpose evaluations, installation and commissioning, system changes or improvements or other mechatronic engineering-related tasks. It includes application of mechanical, fluid, electrical and controller design and analytical techniques.

## Application of the Unit

This unit applies to mechatronic analyses undertaken as part of a mechatronic engineering design or assessment of automated plant or devices for projects, system changes or improvements.

It is suitable for people working as mechatronic or automated system designers and draftspersons and those pursuing careers and qualifications in mechatronic, automation, maintenance or manufacturing engineering. The work may be undertaken individually or as part of a team.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications
MEM14090A	Integrate mechatronic fundamentals into an engineering task

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

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|---|---|-----|--|
| 1 | Investigate mechatronic analysis context and need | 1.1 | Review the context and negotiate parameters of the engineering design brief in consultation with stakeholders  |
|   |   | 1.2 | Identify relevant engineering scientific principles and required analysis techniques   |
|   |   | 1.3 | Investigate life cycle design and sustainability implications of mechatronic design or existing mechatronic systems, devices or equipment              |
|   |   | 1.4 | Determine specification, documentation and graphical techniques required for analysis  |
|   |   | 1.5 | Confirm work health and safety (WHS), regulatory requirements, codes of practice, standards, and risk management relevant to mechatronic analysis task |
|   |   | 1.6 | Determine available sources for any required technical and professional assistance   |
|   |   |     |  |
| 2 | Apply mechatronic analysis techniques             | 2.1 | Plan, schedule and coordinate the analysis task  |
|   |   | 2.2 | Create adequate and accurate calculations, preliminary graphics and maintain design process records  |
|   |   | 2.3 | Evaluate multiple solutions against analysis criteria  |
|   |   | 2.4 | Integrate mechatronic techniques, hardware and software, including mechanical, fluid, electrical, electronic, controller and networking                |

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|---|----------------|---|
|   | 2.5            | Apply systems thinking, problem solving and decision making   |
|   | 2.6            | Incorporate professional and technical assistance, as required  |
|   | 2.7            | Apply specification, documentation and graphical techniques modelling, mock-up or prototyping techniques, where required, to achieve or test solution                     |
| 3 | Report results |   |
|   | 3.1            | Record results of analysis  |
|   | 3.2            | Provide documentation such as calculations, specifications, diagrams, computer-aided design (CAD) files, control circuits and controller programs, mock-ups or prototypes |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating and negotiating with stakeholders and team
- determining or confirming relevance of mechatronic scientific principles and analysis techniques, including principles of:
  - mechanical
  - fluid power
  - fluid dynamics
  - thermodynamics
  - electrical and electronic fundamentals
  - controller and system control and data acquisition (SCADA) or distributed control systems (DCS) programming
  - engineering materials, properties and processes
  - techniques for integration of mechanical, fluid, electrical, electronic, controller and networking elements
- evaluating relevance of WHS, and regulatory requirements, standards and codes of practice
- evaluating multiple solutions against design criteria, risk, sustainability and cost factors

- applying life cycle design and sustainability parameters to analysis task
- planning, scheduling and coordinating the mechatronic analysis task
- solving problems and making decisions with systems thinking approach for contingencies and constraints, and continuous improvement
- integration of hardware and software and mechatronic techniques, such as mechanical, fluid, electrical, electronic, controller and networking
- specifying, documenting and applying graphical techniques, including modelling
- undertaking or supervising mock-up or prototyping techniques, where required, to achieve solution
- creating and maintaining adequate and accurate calculations and analysis process records
- reporting and documenting, results of investigations, application of principles and techniques, calculations, specifications, diagrams, CAD files, mock-ups or prototypes of designs

## Required knowledge

Required knowledge includes:

- implications of life cycle design, fitness for purpose evaluation and sustainability for mechatronic analysis process
- mechatronic analysis processes and techniques to investigate, synthesise and develop proposals, evaluate feasibility against design criteria, and review and revise in consultation with stakeholders, team or support functional group
- common model, mock-up and prototyping techniques relevant to mechatronic engineering
- systems thinking, problem solving and decision making, and continuous improvement methods
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements with particular emphasis on automation safety requirements
- sources of professional and technical assistance
- procedures for planning, scheduling and coordination of analysis
- hardware requirements of typical mechatronic or automation applications
- engineering mechatronic scientific principles and techniques required for analysis tasks:
  - mechanical
  - fluid power
  - fluid dynamics
  - thermodynamics
  - electrical and electronic fundamentals
  - controller and SCADA or DCS programming
  - engineering materials, properties and processes
  - techniques for integration of mechanical, fluid, electrical, electronic, controller and networking elements
- mechatronic analysis calculations techniques
- software for product planning and design, such as CAD, circuit design, controller



- programming and project management
- required documentation prototyping options, including mock-ups, physical and virtual modelling and rapid prototyping

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply mechatronic design techniques consistent with a design brief information, relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>communicate, negotiate and review design brief with stakeholders and team or support functional group</li> <li>determine or confirm relevant scientific principles and analysis techniques, WHS and regulatory requirements</li> <li>evaluate multiple solutions</li> <li>investigate life cycle design and sustainability</li> <li>plan, schedule and coordinate the design task</li> <li>integrate mechatronic techniques, hardware and software</li> <li>solve problems and make decisions with systems thinking for contingencies and constraints, and continuous improvement</li> <li>define analysis, specify and document and apply graphical techniques, modelling, mock-up or prototyping techniques</li> <li>create and maintain adequate and accurate calculations and design process records</li> <li>report and document results and processes.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical</li> </ul>

	resources should include equipment modified for people with disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Mechatronic engineering analysis</b>	<p>Mechatronic engineering analysis may be required for a variety of reasons, including:</p> <ul style="list-style-type: none"> <li>• design of automated devices and plant</li> <li>• design or evaluation of significant modifications, process changes or improvements</li> <li>• sustainability issues relevant to plant, equipment or processes</li> <li>• fitness for purpose evaluation</li> <li>• installation and commissioning of plant and equipment</li> </ul>
<b>Planning processes</b>	<p>Planning processes may include:</p> <ul style="list-style-type: none"> <li>• establishing design parameters and design criteria</li> </ul>

	<ul style="list-style-type: none"> <li>• contributing to the negotiation and advice process</li> <li>• preliminary planning, design investigations and costing</li> <li>• identifying design, development, prototyping activities and skills requirements</li> <li>• planning and scheduling design activities</li> <li>• improving, adjusting and rescheduling as required by emergency contingencies and constraints</li> </ul>
<b>Analysis process</b>	<p>Designing as a systematic process includes:</p> <ul style="list-style-type: none"> <li>• establish design parameters and criteria</li> <li>• research, measurement, experimentation and investigation</li> <li>• generating ideas</li> <li>• synthesis, problem solving and decision making, and addressing constraints</li> <li>• apply scientific principles, calculation and graphics, prototyping and mock-up techniques</li> <li>• evaluating solutions against design criteria</li> <li>• consultation, adjustments and agreement</li> <li>• finalise design and sign-off</li> </ul>
<b>Analysis criteria</b>	<p>Analysis includes relevant technical criteria and may also include criteria relating to:</p> <ul style="list-style-type: none"> <li>• function</li> <li>• aesthetics</li> <li>• manufacturability and maintainability</li> <li>• marketability</li> <li>• sustainability</li> <li>• cost constraints</li> <li>• ergonomics and anthropometrics and physiology</li> <li>• manufacturability, maintainability</li> <li>• facilities, plant and skills available</li> <li>• safety and risk</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>

<b>Life cycle assessment</b>	<p>Life cycle analysis can be used to improve sustainability of products and services. It may be applied to:</p> <ul style="list-style-type: none"> <li>• all aspects of manufacture of a single product</li> <li>• the entire operations of an organisation</li> <li>• a particular aspect of operations, such as environmental implications</li> </ul>
<b>Prototyping</b>	<p>Prototyping may include:</p> <ul style="list-style-type: none"> <li>• mock-ups, physical and virtual modelling with post-processing for computer numeric control (CNC) and rapid prototyping</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular mechatronic analysis task</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or</p>

	support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Automation safety</b>	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and programmable electronic control systems'
<b>Mechatronic hardware</b>	<p>Mechatronic hardware may include:</p> <ul style="list-style-type: none"> <li>• mechanical, fluid and electric actuators</li> <li>• power transmission devices</li> <li>• pipes, conduits wires, fittings and connectors</li> <li>• controllers</li> <li>• power interfaces</li> <li>• signal conditioning interfaces</li> </ul>
<b>Documentation</b>	<p>Documentation includes:</p> <ul style="list-style-type: none"> <li>• documented calculations</li> <li>• specifications</li> <li>• CAD files</li> <li>• risk analysis</li> <li>• sustainability and life cycle assessments</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Planning

## Custom Content Section

Not applicable.

# **MEM14087A Apply manufactured product design techniques**

## **Modification History**

Release 1 - New unit. Replaces MEM14063A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the application of engineering design techniques to manufactured products. It includes documentation of the design process, calculations, specifications, computer-aided design (CAD) files, risk analysis, sustainability and life cycle assessments.

## **Application of the Unit**

This unit applies to where engineering and related skills and knowledge are required for the design of manufactured products or components. The unit applies to people working individually or as part of a team. It is suitable for individuals working alone as designers on simpler manufactured product and component design or as part of a design team consisting of other paraprofessional and professional engineering designers. The unit is also suitable for design draftspersons undertaking design tasks.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM14089A Integrate mechanical fundamentals into an engineering task

MEM23004A Apply technical mathematics

MEM23063A Select and test mechanical engineering materials

MEM23109A Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Investigate manufactured product design requirements	1.1	Review product design brief
		1.2	Determine engineering and scientific principles and design techniques required for product design process
		1.3	Investigate life cycle design and sustainability implications of design requirement
		1.4	Determine required specification, documentation and graphical techniques to define design
		1.5	Confirm work health and safety (WHS) and other regulatory requirements
		1.6	Identify codes, standards and risk management requirements
		1.7	Investigate software requirements for product design process
2	Apply manufactured product design techniques	2.1	Plan, schedule and coordinate the design task
		2.2	Analyse available materials, components, manufacturing processes, tooling and suppliers against design requirements
		2.3	Create adequate and accurate calculations, preliminary graphics and maintain design process records
		2.4	Evaluate multiple solutions against design criteria, risk, failure mode, sustainability and cost
		2.5	Apply systems thinking, problem solving and decision making techniques in dealing with contingencies and constraints, continuous improvement and development of design options

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|---|----------------|--|
|   | 2.6            | Incorporate professional and technical assistance, as required   |
|   | 2.7            | Finalise specification and documentation, modelling, mock-up or prototyping                                  |
| 3 | Report results | 3.1 Record results of investigations, application and development of design                                  |
|   |                | 3.2 Provide documentation, such as calculations, specifications, diagrams, CAD files, mock-ups or prototypes |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating and negotiating with stakeholders
- determining or confirming appropriate engineering and scientific principles for product or component design task
- determining sustainability, WHS, regulatory and risk management requirements
- evaluating multiple solutions for materials and components, manufacturing processes, tooling and component supply for product
- investigating life cycle and sustainability of a design
- evaluating requirement for technical and professional assistance
- planning, scheduling and coordinating a design task
- solving problems and making decisions with systems thinking for contingencies and constraints, and continuous improvement
- specifying and documenting designs, including applying graphical techniques, modelling, mock-up or prototyping techniques
- creating and maintaining adequate and accurate calculations and design process records
- reporting and documenting results of investigations, application of principles and techniques, calculations, specifications, diagrams, CAD files, mock-ups or prototypes of designs

### Required knowledge



Required knowledge includes:

- sustainability implications of materials, product and processes, including consideration of life cycle analysis
- manufactured product design processes and techniques
- systems thinking, problem solving and decision making, and continuous improvement methods
- WHS and regulatory requirements, standards and risk assessment for design, and prototyping activities
- sources of professional and technical assistance procedures for planning, scheduling and coordination of design
- typical product design criteria
- design calculation techniques
- product planning and design software, such as for CAD, stress analysis and project management
- design process documentation, records and reports, including specifications and CAD graphics
- typical materials and components used in manufacturing
- tooling, plant and processes for particular products and materials
- characteristics of cast, forged, machined and sheet metal components, moulded and extruded plastic components, and components made from other materials or by other processes
- professional and technical assistance for product development

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply manufactured product design techniques consistent with a design brief, relevant standards and conventions. It includes working individually and as part of a team in accordance with organisational procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• communicate, negotiate and review design brief with stakeholders</li> <li>• determine or confirm scientific principles and design techniques, WHS and regulatory requirements, and design specification requirements</li> <li>• evaluate multiple solutions, materials and components,</li> </ul>

	<p>manufacturing processes, tooling and component supply chain for product</p> <ul style="list-style-type: none"> <li>investigate life cycle design and sustainability, technical and professional assistance required</li> <li>plan, schedule and coordinate the design task</li> <li>select design components using design process and scientific principles</li> <li>solve problems and make decisions with systems thinking for contingencies and constraints and continuous improvement</li> <li>define designs, specify and document and apply graphical techniques, modelling, mock-up or prototyping techniques</li> <li>create and maintain adequate and accurate calculations and design process records</li> <li>report and document results and processes.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Context of manufactured product design</b>	<p>The context for product design activity may include:</p> <ul style="list-style-type: none"> <li>• budget and market considerations</li> <li>• technological advantages/disadvantages of materials, equipment and suppliers</li> <li>• resources supply (e.g. materials, labour and skills)</li> <li>• sustainability issues relevant to design task (e.g. WHS, risk management, standards and codes of practice)</li> </ul>
<b>Planning processes</b>	<p>Planning processes may include:</p> <ul style="list-style-type: none"> <li>• establishing design parameters and design criteria</li> <li>• contributing to the negotiation and advice process</li> <li>• preliminary planning, design investigations and costing</li> <li>• identifying design, development, prototyping activities and skills requirements</li> <li>• planning and scheduling design activities</li> <li>• improving, adjusting and rescheduling as required by emergency contingencies and constraints</li> </ul>
<b>Design process</b>	<p>Designing as a systematic process includes:</p> <ul style="list-style-type: none"> <li>• establish design parameters and criteria</li> <li>• research, measurement, experimentation and investigation</li> <li>• generate ideas and develop proposals</li> <li>• synthesis, problem solving and decision making, and addressing constraints</li> <li>• apply scientific principles, calculation and graphics, prototyping and mock-up techniques</li> <li>• evaluate solutions against design criteria</li> <li>• review and revision of design in consultation with stakeholders</li> <li>• finalise design and sign-off</li> </ul>

<b>Design criteria</b>	<p>Design criteria include:</p> <ul style="list-style-type: none"> <li>• function</li> <li>• aesthetics</li> <li>• manufacturability and maintainability</li> <li>• marketability</li> <li>• sustainability, including life cycle analysis</li> <li>• cost constraints on costs of design, development, tooling up, manufacture, marketing and distribution</li> <li>• ergonomics and anthropometrics and physiology</li> <li>• facilities, plant and skills available</li> <li>• safety and risk</li> </ul>
<b>Analysis</b>	<p>Analysis may include:</p> <ul style="list-style-type: none"> <li>• product and component performance requirements</li> <li>• assessment against manufacturing capability of organisation</li> <li>• failure mode effects and risk</li> <li>• static and dynamic analysis of loads</li> <li>• the stresses and deformations resulting</li> <li>• graphical and mathematical methods and software options</li> <li>• suitability of materials for purpose and manufacturing process</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Life cycle assessment</b>	<p>Life cycle analysis can be used to improve sustainability of products and services. It may be applied to:</p> <ul style="list-style-type: none"> <li>• all aspects of manufacture of a single product</li> <li>• the entire operations of an organisation</li> <li>• a particular aspect of operations, such as environmental implications</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as:</li> </ul>

	<ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> <li>• professional support for technologies, such as:             <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to the design task
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Product manufacturability</b>	<p>Design for manufacture includes consideration of manufacturing processes and plant, such as the use of group technologies. Manufacturability may be enhanced by concurrent product and process design.</p>
<b>Prototyping</b>	<p>Prototyping may include:</p> <ul style="list-style-type: none"> <li>• mock-ups, physical and virtual modelling with post-processing</li> </ul>

	for computer numeric control (CNC) and rapid prototyping
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## Unit Sector(s)

### Competency field

Unit sector      Planning

## Custom Content Section

Not applicable.

# **MEM14088A Apply maintenance engineering techniques to equipment and component repairs and modifications**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills needed to apply maintenance engineering techniques to equipment or component modification or repair. It includes decision making on the need for repair, replacement or modification and design of any repair or modification. The unit covers maintenance techniques for repair and modification of mechanical, fluid and electrical plant, and facilities in accordance with procedures, work health and safety (WHS) and legislative requirements, and risk management procedures. Documentation of the repair or modification process includes calculations, specifications, computer-aided design (CAD) files, risk analysis, sustainability and life cycle assessments.

## **Application of the Unit**

This unit applies to maintenance-related work where a technical evaluation must occur on whether to repair, replace or modify equipment or components and where engineering design techniques are applied where repair or modification is required. The unit applies across all engineering disciplines and would normally be selected in conjunction with appropriate technical units for the equipment or components being considered for maintenance.

The unit includes reviewing condition analysis and non-destructive test (NDT) reports. However, the conduct of condition analysis and NDT tests is covered by the relevant specialist technical units.

Where an organisation or whole of plant maintenance management systems is being reviewed or considered for change the unit MEM23125A Evaluate maintenance systems, should be selected.

The unit is suitable for people working at a technician level in maintenance-related design drafting or in maintenance-related supervision or management.

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

MEM14092A Integrate maintenance fundamentals into an engineering task

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Investigate requirements of equipment or component maintenance task	1.1	Review the context and parameters of the maintenance task in consultation with stakeholders
		1.2	Review equipment or component original design and any subsequent modifications and repairs
		1.3	Review current performance specifications
		1.4	Determine engineering scientific principles and design techniques required for equipment or component maintenance
2	Investigate alternatives of repair, replacement or modification	2.1	Review preventative maintenance system requirements or defect/failure details to determine if replacement is required
		2.2	Review equipment or component condition analysis reports, including the results of any required NDT
		2.3	Review maintenance repair techniques and processes, standard parts, labour and skill requirements
		2.4	Consider life cycle design and sustainability implications of maintenance design and maintenance



- activities
- 2.5 Determine specification, documentation and graphical techniques required to define designs
  - 2.6 Confirm WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements relevant to repair and modification design projects
  - 2.7 Assess the need for technical and professional assistance
  - 2.8 Consider software options for repair and modification design, such as computer-aided design (CAD), stress analysis and project management software
  - 2.9 Decide if repair, replacement or modification is appropriate and seek any necessary approvals
- 3 Apply repair and modification design techniques
- 3.1 Plan, schedule and coordinate the repair or modification design task
  - 3.2 Apply the design process and scientific principles to repair and modification design proposals
  - 3.3 Determine materials, components, maintenance processes, equipment and tools required to implement design
  - 3.4 Create adequate and accurate calculations, preliminary graphics and maintain design process records, including use of software, as appropriate
  - 3.5 Assess repair and modification designs against design criteria
  - 3.6 Apply systems thinking to problem solving and decision making techniques in dealing with contingencies and constraints for continuous improvement and development of design options
  - 3.7 Incorporate professional and technical assistance, as required
  - 3.8 Use specification, documentation and graphical techniques, modelling, mock-up or prototyping techniques, as appropriate, to define repair or modification

- |   |                |     |  |
|---|----------------|-----|--|
| 4 | Report results | 4.1 | Record results of investigations, application and development of repair and modification design                      |
|   |                | 4.2 | Provide appropriate documentation, such as calculations, specifications, diagrams, CAD files, mock-ups or prototypes |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining or confirming scientific principles and maintenance design techniques, WHS and regulatory requirements, and design specification requirements required to meet maintenance brief
- evaluating multiple solutions, materials and components, maintenance repair processes and techniques, standard parts, skill requirements, equipment and tools
- investigating life cycle design and sustainability, technical and professional assistance alternatives for repair, replacement or improvement, and software options for maintenance planning and design
- planning, scheduling and coordinating the maintenance task
- applying design process and scientific principles to component and hardware selection and design proposals
- solving problems and making decisions with systems thinking for contingencies and constraints, and continuous improvement
- defining designs, specifying and documenting and applying graphical techniques, modelling, mock-up or prototyping techniques
- creating and maintaining adequate and accurate calculations and design process records
- reporting and documenting results of investigations, application of principles and techniques, calculations, specifications, diagrams, CAD files, mock-ups or prototypes of designs

### Required knowledge

Required knowledge includes:

- sustainability implications of maintenance processes, materials and products, including consideration of life cycle analysis
- design processes and techniques

- concurrent engineering techniques, systems thinking, problem solving and decision making, and continuous improvement methods
- WHS Acts and regulations, codes of practice, standards, registration and risk assessment for design, maintenance and prototyping activities
- procedures for planning, scheduling and coordination of maintenance design
- typical maintenance criteria, such as:
  - strength and servability of repairs compared to original
  - function and aesthetics
  - maintainability and manufacturability
  - preventative maintenance evaluation criteria, such as mean time between failure (MTBF) and failure mode effects analysis (FMEA)
  - required quality, cost and sustainability
- design calculations techniques
- typical maintenance design requirements of various industries
- typical repairs, parts, skills and maintenance processes
- hardware specifications and catalogues
- typical maintenance plant, equipment and tools
- plant condition and maintenance assessment techniques
- typical maintenance techniques and technologies for monitoring, preventative maintenance, online and breakdown maintenance, disassembly, repair, reassembly and recommission
- design calculations layout and documentation for design checking and maintenance records
- design process documentation and reports, including specifications and CAD graphics
- software for maintenance planning and repair and modification design, including CAD and stress analysis software
- software and systems, such as system control and data acquisition (SCADA) and distributed control systems (DCS) for maintenance control and information distribution
- developments in repair and modification design
- options for mock-up, modelling and prototyping

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply repair and modification techniques consistent with a
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	design brief information, relevant standards and conventions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• communicate, negotiate and review maintenance brief with stakeholders</li> <li>• determine or confirm scientific principles and design techniques, WHS and regulatory requirements, and design specification requirements</li> <li>• evaluate multiple solutions</li> <li>• investigate life cycle design, sustainability, technical and professional assistance required, and maintenance alternatives for repairs and modifications</li> <li>• plan, schedule and coordinate the maintenance task</li> <li>• solve problems and make decisions with systems thinking for contingencies and constraints, and continuous improvement</li> <li>• define designs, specify and document and apply graphical techniques, modelling, mock-up or prototyping techniques</li> <li>• select components and hardware</li> <li>• create and maintain adequate and accurate calculations and design process records</li> <li>• report and document results and processes.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions</li> </ul>

	<p>(real or simulated) and require evidence of process.</p> <ul style="list-style-type: none"> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Maintenance repair and modification requirements</b>	<p>Maintenance repair and modification requirements may include:</p> <ul style="list-style-type: none"> <li>• scheduled maintenance required under the maintenance management system</li> <li>• unscheduled maintenance as a result of system/component failure</li> <li>• repairs to restore systems/components to operation</li> <li>• modifications to improve system/component reliability or maintainability</li> <li>• maintenance schedule change or equipment or component modification required because of a change in equipment performance requirements (e.g. changed production or product design)</li> <li>• competitive market pressure and 'lean maintenance'</li> <li>• changes in available maintenance technology</li> <li>• resources supply (e.g. materials, labour and skills)</li> <li>• introduction or changes to asset technologies (e.g. mechanical, fluid, electrical, electronic and system control)</li> <li>• sustainability relevant to repair and modification design tasks</li> <li>• WHS, risk and applicable standards and code requirements</li> </ul>
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<b>Planning processes</b>	<p>Planning processes may include:</p> <ul style="list-style-type: none"> <li>• establishing maintenance parameters and design criteria</li> <li>• contributing to the negotiation and advice process</li> <li>• preliminary planning, investigations and costing</li> <li>• identifying design, development, prototyping activities and skills requirements</li> <li>• planning and scheduling design activities</li> <li>• improving, adjusting and rescheduling as required by emergency contingencies and constraints</li> </ul>
<b>Design process</b>	<p>Where equipment or component repair or modification design is required the design process includes:</p> <ul style="list-style-type: none"> <li>• establish design parameters and criteria</li> <li>• research, measurement, experimentation and investigation</li> <li>• generating ideas</li> <li>• synthesis, problem solving and decision making, and addressing constraints</li> <li>• apply scientific principles, calculation and graphics, prototyping and mock-up techniques if required</li> <li>• selection of components and hardware</li> <li>• evaluating solutions against design criteria</li> <li>• consultation, adjustments and agreement</li> <li>• finalise design and sign-off</li> </ul>
<b>Design criteria</b>	<p>Design criteria may include:</p> <ul style="list-style-type: none"> <li>• function and fit for purpose</li> <li>• aesthetics</li> <li>• manufacturability and maintainability</li> <li>• sustainability</li> <li>• cost constraints</li> <li>• ergonomics and anthropometrics and physiology</li> <li>• facilities, plant, services and skills available</li> <li>• WHS and risk</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> </ul>

	<ul style="list-style-type: none"> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Life cycle assessment</b>	Life cycle analysis can be used to improve sustainability of repaired or modified equipment or components. It may be applied to all aspects of the repair or modification process
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular maintenance repair and

	modification design task
<b>Prototyping</b>	Prototyping may include: <ul style="list-style-type: none"><li>• mock-ups, physical and virtual modelling with post-processing for computer numeric control (CNC) and rapid prototyping</li></ul>
<b>Systems thinking</b>	Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain

## Unit Sector(s)

### Competency field

**Unit sector** Planning

## Custom Content Section

Not applicable.



# **MEM14089A Integrate mechanical fundamentals into an engineering task**

## **Modification History**

Release 1 - New unit. Replaces MEM14081A and MEM23071A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the integration of mechanical fundamentals to achieve an engineering or related task. It includes identifying task parameters, personal and team functions, chain of responsibility and work health and safety (WHS) guidelines. It includes investigation of machines, mechanisms and mechanical systems, and mechanical fundamentals, such as mechanical methods and processes, workshop techniques, materials, scientific and mathematical principles and computer software. It requires completion of the task in cooperation with the team and documentation of the process and outcomes.

## **Application of the Unit**

The unit applies to engineering or related projects requiring mechanical engineering skills and covers the identification, application and integration of mechanical fundamentals. It is suitable for people working as mechanical designers and draftspersons and those pursuing careers and qualifications in mechanical engineering.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanics principles

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                       |     |  |
|---|---------------------------------------|-----|--|
| 1 | Investigate scope of engineering task | 1.1 | Identify mechanical and related fundamentals to be integrated into engineering task  |
|   |                                       | 1.2 | Identify stakeholders to be consulted  |
|   |                                       | 1.3 | Confirm WHS, regulatory requirements, risk management and organisational procedures  |
|   |                                       | 1.4 | Review functions and features of machines, mechanisms and mechanical systems required by the task  |
|   |                                       | 1.5 | Review software techniques required for task analysis and graphics   |
| 2 | Integrate mechanical fundamentals     | 2.1 | Use systems thinking to address contingencies and constraints, problem solving and decision making, and continuous improvement to achieve integration task |
|   |                                       | 2.2 | Integrate mechanical fundamentals to achieve task objectives   |
|   |                                       | 2.3 | Seek technical and professional assistance or clarification of design information, as required   |
| 3 | Report results                        | 3.1 | Record results of investigation, evaluation and integration  |
|   |                                       | 3.2 | Provide documentation, such as diagrams and calculations, programs and files   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, cooperating and negotiating with stakeholders
- identifying parameters and context, WHS and regulatory requirements, risk management and organisational procedures
- evaluating requirements, principles, techniques, and typical applications related to task
- selecting software for required analysis and graphics
- planning the task
- solving problems and making decisions using systems thinking and continuous improvement to address contingencies and constraints
- reporting and documenting results of investigation, evaluation and integration, diagrams and calculations
- reviewing sustainability implications, functions and features for the engineering task

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, and risk minimisation and registration requirements
- mechanical and related fundamentals, including:
  - materials properties
  - mechanics
  - chemistry
  - thermodynamics
  - fluid mechanics
  - fluid power
  - electrical fundamentals
  - and may also include depending on the application:
    - light, sound and electromagnetic effects
- methods and processes for shaping, cutting, joining and coating of metal and other materials
- functions and features of machines, mechanisms and mechanical systems
- current options and trends in software, including system layout and simulation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake investigation of an engineering task to determine the mechanical fundamentals required by the task and integrating them into a task plan and report the plan and any investigations undertaken.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine task parameters and context and identify and investigate required mechanical fundamentals</li> <li>• evaluate task requirements, principles, techniques, typical applications and software</li> <li>• plan the task</li> <li>• integrate mechanical fundamentals to achieve task objectives</li> <li>• communicate, cooperate and negotiate with stakeholders to achieve integration task</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment must cover the integration of two or more mechanical fundamentals to achieve the engineering task.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Mechanical and related fundamentals</b>	<p>Mechanical and related fundamentals include fundamentals of:</p> <ul style="list-style-type: none"> <li>• materials properties</li> <li>• mechanics</li> <li>• chemistry</li> <li>• thermodynamics</li> <li>• fluid mechanics</li> <li>• fluid power</li> <li>• electrical fundamentals</li> </ul> <p>and may also include depending on the application:</p> <ul style="list-style-type: none"> <li>• light, sound and electromagnetic effects</li> </ul>
<b>Machines, mechanisms</b>	Machines, mechanisms and mechanical systems may include:

<b>and mechanical systems</b>	<ul style="list-style-type: none"> <li>• piston and rotary displacement engines</li> <li>• liquid, gas and steam turbines</li> <li>• pumps and pumping systems</li> <li>• compressors and pneumatic distribution systems</li> <li>• hydraulic systems</li> <li>• fans and ducting systems</li> <li>• heating, ventilation, air conditioning and refrigeration (HVAC/R) systems</li> <li>• mechanical drive systems and transmissions</li> <li>• brakes and clutches</li> <li>• conveyors, elevators, cranes and materials handling plant</li> <li>• boilers and piping systems</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or</p>

	<p>projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"><li>• balanced scorecard</li><li>• current and future state mapping</li><li>• measuring performance against benchmarks</li><li>• process improvement, problem solving and decision making</li><li>• data management, generation, recording, analysing, storing and use of software</li><li>• training for improvement systems participation</li><li>• technical training</li></ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may include:</p> <ul style="list-style-type: none"><li>• financial</li><li>• organisation procedural or culture</li><li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li></ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Planning

## **Custom Content Section**

Not applicable.



# **MEM14090A Integrate mechatronic fundamentals into an engineering task**

## **Modification History**

Release 1 - New unit. Replaces MEM14082A and MEM23072A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the integration of mechatronic fundamentals to achieve an engineering or related task. It includes identifying task parameters, personal and team functions, and work health and safety (WHS) requirements. It includes investigation of programmable machines, controllers and mechatronic devices, and automated systems and mechatronic fundamentals, including mechatronic methods and processes, workshop techniques, materials, scientific and mathematical principles and computer software. It requires completion of the task in cooperation with the team and documentation of the process and outcomes.

## **Application of the Unit**

The unit applies to engineering or related projects requiring mechatronic engineering skills and covers the identification, application and integration of mechatronic fundamentals. It is suitable for people working as mechatronic or automation technicians and drafters and those pursuing careers and qualifications in mechatronic engineering.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                       |     |  |
|---|---------------------------------------|-----|--|
| 1 | Investigate scope of engineering task | 1.1 | Identify mechatronic and related fundamentals to be integrated into engineering task   |
|   |                                       | 1.2 | Identify stakeholders to be consulted  |
|   |                                       | 1.3 | Review functions and features of machines, controllers, devices and automated systems requiring mechatronics   |
|   |                                       | 1.4 | Confirm WHS, regulatory requirements, risk management and organisational procedures  |
|   |                                       | 1.5 | Review software techniques required for task analysis and graphics   |
| 2 | Integrate mechatronic fundamentals    | 2.1 | Use systems thinking to address contingencies and constraints, problem solving and decision making, and continuous improvement to achieve integration task |
|   |                                       | 2.2 | Integrate mechatronic fundamentals to achieve task objectives  |
|   |                                       | 2.3 | Seek technical and professional assistance or clarification of design information, as required   |
| 3 | Report results                        | 3.1 | Record results of investigation, evaluation and integration  |
|   |                                       | 3.2 | Provide documentation, such as diagrams, calculations, programs and files  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, cooperating and negotiating with stakeholders
- identifying task parameters and context, WHS and regulatory requirements, risk management and organisational procedures
- evaluating task requirements, including principles, techniques, machines, controllers and mechatronic devices, and typical automated systems
- selecting and using software for required analysis and graphics
- planning the task
- solving problems and making decisions using systems thinking and continuous improvement to address contingencies and constraints

reporting and documenting results of investigation, evaluation and integration, diagrams and calculations

- reviewing sustainability implications, functions and features for the engineering task

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, and risk minimisation and registration requirements
- mechatronic fundamentals, including:
  - mathematics
  - materials properties
  - mechanics
  - electrical and electronic fundamentals

fundamentals of controller programming, interfacing and signal conditioning, and which depending on the application may also include:

- chemistry
- light, sound and electromagnetic effects
- thermodynamics and heating, ventilation and air conditioning (HVAC)
- fluid mechanics
- fluid power
- system control and data acquisition systems (SCADA) and distributed control systems

(DCS)

- computing
- graphics, including computer-aided design and drafting systems (CAD)
- methods and processes for shaping, cutting, joining and coating of metal and other materials
- functions and features of machines, controllers and mechatronic devices and automated systems
- current options and trends in software, including circuit and system layout and simulation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake investigation of an engineering task to determine the mechatronic fundamentals required by the task and integrating them into a task plan and report the plan and any investigations undertaken.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• determine task parameters and context and identify and investigate required mechatronic fundamentals</li> <li>• evaluate task requirements, principles, techniques, typical applications and software</li> <li>• plan the task</li> <li>• integrate mechatronic fundamentals to achieve task objectives</li> <li>• communicate, cooperate and negotiate with stakeholders to achieve integration task</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to</li> </ul>

	<p>accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment must cover the integration of two or more mechatronic fundamentals to achieve the engineering task.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate licensed technical and professional</b>	Appropriate licensed technical and professional assistance may
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<b>assistance</b>	<p>include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies may include: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p>

	<p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"><li>• balanced scorecard</li><li>• current and future state mapping</li><li>• measuring performance against benchmarks</li><li>• process improvement, problem solving and decision making</li><li>• data management, generation, recording, analysing, storing and use of software</li><li>• training for improvement systems participation</li><li>• technical training</li></ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may include:</p> <ul style="list-style-type: none"><li>• financial</li><li>• organisation procedural or culture</li><li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li></ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular engineering integration task</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Planning

## Custom Content Section

Not applicable.



# **MEM14091A Integrate manufacturing fundamentals into an engineering task**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the integration of manufacturing fundamentals to achieve an engineering or related task. It includes identifying task parameters, personal and team functions, and work health and safety (WHS) guidelines. It includes investigation of function and features of manufacturing plant, methods and processes and manufacturing fundamentals, including workshop techniques, materials, scientific and mathematical principles, and computer software.

## **Application of the Unit**

The unit applies to engineering or related projects requiring manufacturing engineering skills and covers the identification, application and integration of manufacturing fundamentals. It is suitable for people working as manufacturing technicians and draftspersons and those pursuing manufacturing engineering or related technical qualifications and careers.

If applying the unit into an enterprise or context where knowledge and skills of lean manufacturing techniques is also required, relevant competitive systems and practices units should also be selected.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Investigate scope of engineering task	1.1	Identify manufacturing engineering and related fundamentals to be integrated into engineering task
		1.2	Review current functions and features of manufacturing plant, methods and processes, including production control, process maintenance options, and continuous improvement and lean manufacturing-related systems and processes
		1.3	Identify stakeholders to be consulted
		1.4	Confirm WHS, regulatory requirements, risk management and organisational procedures
		1.5	Review software techniques required for task analysis and graphics
2	Integrate manufacturing fundamentals	2.1	Plan the task
		2.2	Communicate, cooperate and negotiate with stakeholders, as required
		2.3	Use systems thinking to address contingencies and constraints, problem solving and decision making, and continuous improvement to achieve integration task
		2.4	Integrate manufacturing fundamentals to achieve task objectives
		2.5	Seek technical and professional assistance or clarification of design information, as required
3	Report results	3.1	Record results of investigation, evaluation and integration

### 3.2 Provide documentation, such as diagrams, graphics, flow charts and calculations

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, cooperating and negotiating with stakeholders
- identifying task parameters and manufacturing context, WHS, regulatory requirements, risk management and organisational procedures
- evaluating manufacturing principles, systems, methods and processes, and production machinery, such as:
  - lean manufacturing
  - jobbing (individual lot manufacturing)
  - transfer lines
  - cellular manufacturing
  - typical manufacturing departments, such as logistics, warehouse, production, maintenance, scheduling, sales, marketing and administration
- selecting and using software and graphics for required analysis and graphics
- planning the task
- integrating manufacturing fundamentals to achieve task objectives
- solving problems and making decisions using systems thinking and continuous improvement to address contingencies and constraints
- reporting and documenting results of investigation, evaluation and integration, diagrams and calculations
- reviewing sustainability implications, functions and features for the engineering task

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, and risk minimisation and registration requirements
- manufacturing methods, such as:
  - production control and flow
  - continuous improvement
  - lean techniques for quality, speed, quantity and reliability

- manufacturing systems maintenance, such as total productive maintenance
- jobbing, batch and mass systems
- production lines and work cells, and batch and queue manufacturing
- functions and features of production machinery and systems related to the task
- general mechanical, electrical and mechatronic engineering fundamentals relevant to manufacturing, such as:
  - materials properties
  - mechanics
  - chemistry
  - thermodynamics
  - fluid mechanics
  - fluid power
  - electrical fundamentals
- current options and trends in software, including manufacturing process simulation software

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake investigation of an engineering task to determine the manufacturing fundamentals required by the task and integrating them into a task plan and report the plan and any investigations undertaken.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• communicate, cooperate and negotiate with stakeholders to achieve manufacturing integration task</li> <li>• determine task parameters and context and identify and investigate required manufacturing fundamentals</li> <li>• identify relevant WHS, regulatory requirements, risk management and organisational procedures</li> <li>• integrate manufacturing fundamentals to achieve task objectives</li> <li>• report and document results.</li> </ul>

<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as:             <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as:             <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p><b>WHS, regulatory requirements and enterprise procedures may include:</b></p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or</p>

	<p>projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain.</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may include:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisation procedural or culture</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>

<b>Lean principles</b>	Lean manufacturing uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness.

## Unit Sector(s)

### Competency field

**Unit sector** Planning

## Custom Content Section

Not applicable.



# **MEM14092A Integrate maintenance fundamentals into an engineering task**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the integration of maintenance fundamentals to achieve an engineering or related task. It includes identifying task parameters, personal and team functions, and work health and safety (WHS) requirements. It includes investigation of maintainable features of plant, facilities and services, and evaluation of related fundamentals of mathematics, scientific principles, workshop skills, materials and processes, and software required by the task. It requires completion of the task in cooperation with the team and documentation of the process and outcomes.

## **Application of the Unit**

The unit applies to engineering and related tasks in a project or organisation and covers the identification, application and integration of maintenance fundamentals, including breakdown and preventative maintenance fundamentals. It is suitable for people working as maintenance technicians and draftspersons and those pursuing careers and qualifications in maintenance engineering.

This unit should be undertaken in conjunction with technical units relevant to the equipment and processes used in the organisation.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |  |   |
|--|---|
| <b>1 Investigate scope of engineering task</b> | <ul style="list-style-type: none"><li>1.1 Identify the breakdown and preventative maintenance and other related fundamentals to be integrated into engineering task</li><li>1.2 Identify stakeholders to be consulted</li><li>1.3 Confirm WHS, regulatory requirements, risk management and organisational procedures</li><li>1.4 Identify maintainable features of plant, facilities and services affected by integration task</li><li>1.5 Identify methods, processes and workshop techniques required by task</li><li>1.6 Review sustainability implications for task</li><li>1.7 Review software techniques required for task analysis and graphics</li><li>1.8 Plan task to maximise performance and reliability and prevent future breakdowns</li></ul> |
| <b>2 Integrate maintenance fundamentals</b>    | <ul style="list-style-type: none"><li>2.1 Use systems thinking to address contingencies and constraints, problem solving and decision making, and continuous improvement to achieve integration task</li><li>2.2 Consult with stakeholders on timing and scope of integration task</li></ul>  |

- |          |                       |  |
|----------|-----------------------|--|
|          | 2.3                   | Integrate maintenance fundamentals to achieve task objectives                                  |
|          | 2.4                   | Seek technical and professional assistance or clarification of design information, as required |
| <b>3</b> | <b>Report results</b> |  |
|          | 3.1                   | Record results of investigation, evaluation and integration                                    |
|          | 3.2                   | Provide documentation, such as diagrams, calculations, programs and files                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, cooperating and negotiating with stakeholders
- identifying task parameters and context, WHS and regulatory requirements, risk management and organisational procedures
- evaluating task requirements, including principles, methods, processes and construction techniques, maintainable features of plant, facilities and services
- selecting and using software required for analysis and graphics
- evaluating maintenance-related task activities for effect on performance, reliability and prevention of failure
- solving problems and making decisions using systems thinking and continuous improvement to address contingencies and constraints

reporting and documenting results of investigation, evaluation and integration, diagrams and calculations

- reviewing sustainability implications, functions and features for the engineering task

### Required knowledge

Required knowledge includes:

- maintenance and related fundamentals may include:
  - materials properties
  - maintenance methods and processes

- mechanics
- chemistry
- thermodynamics
- fluid mechanics
- fluid power
- electrical and electronic fundamentals
- fundamentals of controller programming, interfacing and signal conditioning
- computing
- graphics, including computer-aided design (CAD)
- workshop and maintenance equipment
- functions and maintainable features of plant, facilities and services
- maintenance methods and procedures:
  - breakdown maintenance
  - preventive maintenance
  - predictive maintenance (on-condition)
  - precision maintenance
  - proactive maintenance
  - reliability centred maintenance and modification
  - total productive maintenance
  - repair and replace methods and processes
- role and application of maintenance-related risk management procedures and analysis
- current options and trends in maintenance software
- typical software applications for engineering maintenance fundamentals

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake investigation of an engineering task to determine the maintenance fundamentals required by the task and integrating them into a task plan and report the plan and any investigations undertaken.
<b>Critical aspects for assessment and</b>	Assessors must be satisfied that the candidate can

<b>evidence required to demonstrate competency in this unit</b>	<p>competently and consistently:</p> <ul style="list-style-type: none"> <li>• communicate, cooperate and negotiate with stakeholders to achieve integration task</li> <li>• determine task parameters and context, chain of responsibility, WHS, regulatory requirements, risk management and organisational procedures</li> <li>• evaluate task requirements, principles, techniques, typical applications and software</li> <li>• plan the task</li> <li>• integrate maintenance fundamentals to achieve task objectives</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> <li>•</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of</li> </ul>

	<p>process.</p> <ul style="list-style-type: none"> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Integrate maintenance fundamentals</b>	Integrate maintenance fundamentals refers to situations where maintenance skills and knowledge must be applied across more than one engineering, system or application area to achieve a task objective
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, may include: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment,</li> </ul> </li> </ul>

	sealing and fastening
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain.</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>

<b>Constraints and contingencies</b>	Constraints and contingencies may include: <ul style="list-style-type: none"><li>• financial</li><li>• organisation procedural or culture</li><li>• physical constraints such as limits to resources, limits to site access or logistical limitations</li></ul>
<b>Maintenance system data</b>	Maintenance system data may include: <ul style="list-style-type: none"><li>• asset ID and plant warranties</li><li>• standard repair schemes</li><li>• modification data and configuration</li><li>• procedural documents:<ul style="list-style-type: none"><li>• monitoring and preventative maintenance schedules</li><li>• safe work methods statements</li><li>• material safety data sheets (MSDS)</li><li>• work permits</li></ul></li><li>• monitoring reports and system measurements</li><li>• maintenance actions and costs</li><li>• spares inventory control</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular engineering integration task
<b>Sustainability</b>	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>



## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Planning

## **Custom Content Section**

Not applicable.

## MEM15001B Perform basic statistical quality control

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers taking samples and applying a statistical process to monitor production.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the collation and interpretation of statistical data in the context of statistical quality control, for example, tally, run or control charts. Uncontrolled variations are reported to appropriate authority.</p> <p>When the production and interpretation of charts and graphs not dependent on knowledge and understanding of the implications for quality are required, Unit MEM12024A (Perform computations) should be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Take samples	1.1.Difference between population and sample is understood and various sampling schemes are applied in accordance with standard operating procedures.
2. Apply statistical process to monitor production	2.1.Concept of variation in terms of average and spread is understood. Data is used to produce relevant statistical information. 2.2.Data is interpreted accurately and information is presented to appropriate authority according to standard operating procedures.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, standard operating procedures, charts, lists, drawings and other applicable reference documents
- applying statistical process control procedures in accordance with instructions to a given production process
- obtaining data from samples including average, range and random or assignable causes
- producing tally, run or control charts from sampling data
- reporting information from sampling data
- checking and clarifying task-related information
- completing proformas and standard workplace forms

### Required knowledge

Look for evidence that confirms knowledge of:

- the difference between population and sample, and the concept of variation in terms of average and range, random and assignable causes
- numerical operations and statistical calculations/formulae within the scope of this unit
- statistical process control procedures, which may include Six Sigma etc. and the sampling procedures to be followed
- the types of charts that can be produced to assist monitoring of products including run charts, tally charts, histograms, control charts
- procedures for reporting sample data information
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to perform basic statistical quality control.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic statistical quality control or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Sampling schemes</b>	Agreed customer plans, Acceptable Quality Level (AQL) and Average Outgoing Quality Level (AOQL) plans, Shainin, Six Sigma etc.
<b>Relevant statistical information</b>	Average, range and process control data and the plotting of charts such as line graphs, run charts, tally charts, histograms, control charts, random and assignable causes etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Quality
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## MEM15002A Apply quality systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers working within a quality improvement system, either individually or in a team situation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is applicable for any work within a quality improvement system in a manufacturing, engineering or related environment. The definition of customer is wide and applies to the next person or organisation receiving the product or service. Application may include quality inspection of own or other employee's work up to the level of the employee's technical competence.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Work within a quality system	<ul style="list-style-type: none"><li>1.1. Instructions and procedures are followed and duties are performed in accordance with requirements of quality improvement system.</li><li>1.2. Conformance to specifications is ensured.</li><li>1.3. Defects are detected and reported according to standard operating procedures.</li><li>1.4. Performance of operation or quality of product or service is monitored to ensure customer satisfaction.</li></ul>
2. Engage in quality improvement	<ul style="list-style-type: none"><li>2.1. Current performance is assessed.</li><li>2.2. Established performance measures are identified.</li><li>2.3. Specifications and standard operating procedures are identified.</li><li>2.4. Defects are detected and reported according to standard operating procedures.</li><li>2.5. Process improvement procedures are participated in.</li><li>2.6. The improvement of internal/external customer/supplier relationships is participated in.</li><li>2.7. Performance of operation or quality of product or service is monitored to ensure customer satisfaction.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job sheets, instructions, standard operating procedures and drawings
- checking and clarifying task-related information
- entering information onto workplace documents
- checking for conformance to specifications
- identifying duties of the individual within the quality improvement system
- identifying customers' requirements with respect to the operation or quality of the product or service
- reporting where appropriate, defects detected
- carrying out work in accordance with the process improvement procedures
- carrying out work in a manner consistent with the improvement of customer/supplier relationships
- performing numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- quality system terminology and concepts, e.g.
  - quality assurance - planning to meet customers' requirements
  - quality control - checks and procedures to ensure customer requirements are met
  - quality inspection - inspecting and testing products and services
  - total quality control - a company-wide approach that combines both quality assurance and quality control so that the customer is always satisfied
- commonly accepted meaning/s of the terms quality and quality system
- the reasons for following the requirements of the quality improvement system
- strategies and approaches for working within a quality system
- procedures to be followed in undertaking the work
- specifications to which the individual's work is to comply
- reasons for ensuring work conforms to specification
- benefits of good quality:

## REQUIRED SKILLS AND KNOWLEDGE

- quality products
- reduced costs
- customer confidence, satisfaction and loyalty
- good reputation
- job satisfaction
- solving problems
- increased competitiveness
- keeping up with technology
- costs and consequences of poor quality e.g.
  - lost customers
  - accidents
  - wastage
  - lost time
  - low morale
  - conflict
- procedures for reporting defects
- examples of common defects
- quality improvement procedures
- four steps of the quality cycle: plan, do, check, act
- reasons for following process improvement procedures
- examples of ways in which customer/supplier relationships can be improved
- benefits of good customer/supplier relationship
- hazards and control measures associated with applying quality procedures, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply quality systems.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying quality systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. <b><i>Bold italicised</i></b>

**RANGE STATEMENT**

wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Quality improvement system**

A system comprising some or all of the following elements:

- quality assurance
- quality control
- quality inspection
- quality improvement
- total quality control

**Customer**

The next person or organisation receiving the production or service

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Quality
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## MEM15003B Use improvement processes in team activities

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying improvements and/or solving problems, implementing/monitoring the implementation of an improvement strategy, and evaluating the improvement.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to quality circle participation using problem solving techniques including flow charts, cause and effect diagrams, Pareto charts, histograms, run charts and graphs, control charts, scattergrams etc. as required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16007A	Work with others in a manufacturing, engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify areas for improvement and/or solve problems	1.1.Participation in team is used to select improvement tools and methods appropriate to the situation. 1.2.Teamwork is used to process improvement tools to identify improvements and/or solve problems.
2. Implement improvement strategy	2.1.Teamwork is used to implement improvement strategies as required in accordance with standard operating procedures. 2.2.In conjunction with work team, further action is recommended as required using standard operating procedures.
3. Monitor implementation of improvement	3.1.Performance is monitored for change, utilising feedback data.
4. Evaluate improvement	4.1.Analytical tools are used to evaluate improvement as required. 4.2.In conjunction with work team, further action is recommended where required using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- participating and communicating in a team setting
- identifying improvements and/or solving problems in a team setting
- implementing improvement strategies in a team setting
- recommending further action in accordance with standard operating procedures
- collecting and collating feedback data
- evaluating the improvement strategy implemented
- reading, interpreting information on written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- planning and sequencing tasks
- checking and clarifying information
- entering information onto workplace documents
- following verbal instructions
- orally reporting routine information

#### Required knowledge

Look for evidence that confirms knowledge of:

- roles and functions of self and team members
- team discussion and problem solving processes
- improvement tools and methods and their application
- procedures for using process improvement tools in the team environment
- improvement strategies
- procedures for implementing the improvement strategies
- the individual's role in implementing improvement strategies
- procedures for initiating further action
- the procedures for collecting and collating improvement feedback data
- the analytical tools and processes to evaluate the improvement strategy
- safe workplace practices



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use improvement processes in a team environment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using improvement processes in team activities or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit of. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for</b>	

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Improvement tools and methods</b>	Flow charts, cause and effect diagrams, Pareto charts, histograms, run charts and graphs, control charts, scattergrams etc.
<b>Improvement strategies</b>	PDCA (Plan, Do, Check, Act) procedures, Six Sigma techniques, Root Cause Analysis, etc.

**Unit Sector(s)****Unit sector****Co-requisite units**

<b>Co-requisite units</b>	

## Competency field

Competency field	Quality
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## MEM15004B Perform inspection

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers inspecting products, keeping records and providing feedback on the conformance of product to specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to basic inspection of completed or partly completed products produced by others. Inspection is carried out according to a site quality plan or specifications; it applies to a range of manufacturing enterprises; and requires application of a range of measuring equipment/devices/tools.</p> <p>Location and frequency of checks/tests and measurements are undertaken to standard operating procedures. In general, verification should be made as close as possible to the point of production of the feature or characteristic. Inspection may involve 'first piece inspection', fixed interval, sample etc. Depending on the inspection process, other technical units may need to be accessed, for example, appropriate measurement units.</p> <p>This unit is not intended to be applied to maintenance personnel carrying out their day-to-day activities, for example, fault finding, remedial and checking activities. These skills are covered by other units such as Unit MEM18006C (Repair and fit engineering components).</p> <p>This unit should not be selected for the purposes of non destructive testing, where Unit MEM24002B (Perform penetrant testing), Unit MEM24004B (Perform magnetic particle testing), Unit MEM24006B (Perform eddy current testing), Unit MEM24008B (Perform ultrasonic testing) or Unit MEM24010B (Perform radiographic testing) have already been selected.</p>
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	<b>Band: A</b> <b>Unit Weight: 2</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Inspect products	1.1. Products are tested for conformance to specifications in accordance with standard operating procedures.
2. Keep records	2.1. Test status identification is made on conforming and non-conforming products and records are accurately kept using standard operating procedures.
3. Provide feedback	3.1. Products are tested/inspected/measured after rework or repair. 3.2. Deficiencies or deviations are reported according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, standard operating procedures and other applicable reference documents
- testing products for conformance to specifications in accordance with job instructions
- testing reworked/repared products for conformance to specification, in accordance with job instructions
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- the procedures as defined by job instructions to be used to check conformance to specifications
- the data to be recorded and the frequency of recording required
- the consequences of not keeping accurate records
- non-conformances of given products that can be removed by rework/repair in accordance with job instructions
- hazards and control measures associated with performing basic inspection activities
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform inspection (basic).
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing inspection (basic) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

<b>EVIDENCE GUIDE</b>	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Tested for conformance to specifications</b>	Visual inspection, physical measurements, chemical tests, checks against patterns, templates and guides etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



## Competency field

Competency field	Quality
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## MEM15005B Select and control inspection processes and procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting inspection and test procedures, and controlling the inspection/test environment and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to a range of manufacturing enterprises where inspection involves working autonomously and taking responsibility for overseeing inspection process and environment.</p> <p>This person would use a wide range of equipment/instruments and take responsibility for the reliability of inspection results to ensure conformance to specifications.</p> <p>This unit is not intended to be applied to maintenance personnel carrying out their day-to-day activities, for example, fault finding, remedial and checking activities. These skills are covered by other units, such as Unit MEM18006C (Repair and fit engineering components)</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM15004B	Perform inspection

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select inspection/test procedures	1.1.Appropriate methods of inspection are selected and implemented. 1.2.Inspection/test procedures are monitored to ensure desired outcomes.
2. Control inspection/test environment and equipment	2.1.Environmental conditions are monitored to ensure reliability of tests and results. 2.2.Equipment/instruments are checked for correct calibration. 2.3.Calibration of equipment/instruments is initiated or undertaken against appropriate standard as required. 2.4.Calibration records are maintained to standard operating procedure.

ELEMENT	PERFORMANCE CRITERIA
	2.5.If equipment/instruments are found to be out of calibration, validity of previous results is checked and reported according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on standard operating procedures and other applicable reference documents
- checking and clarifying task-related information
- entering and maintaining information onto proformas and standard workplace forms and records
- checking for conformance to specifications
- using measurement equipment within the scope of this unit
- measuring components to specified tolerances
- implementing inspection method for the product/ process
- monitoring inspection/test procedures to ensure desired outcomes are achieved
- monitoring environmental conditions
- checking calibration of measuring equipment
- initiating calibration of measuring equipment
- calibrating measuring equipment against the appropriate reference standard
- detecting and reporting out of calibration equipment
- applying units of measurement and numerical operations/calculations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- a range of inspection methods and their application
- the appropriate inspection method for the process/product
- procedures for implementing inspection methods
- the desired/target outcomes of the inspection/test procedures
- reasons for discrepancies/trends
- procedures for monitoring inspection/test procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- the effects of environmental conditions on test equipment and the results
- procedures for monitoring environmental conditions
- the acceptable range of variations to environmental conditions
- the correct operation of the measuring equipment
- the specifications of the measuring equipment
- procedures for checking the calibration of the measuring equipment
- appropriate techniques, tools and equipment to measure components
- units of measurement and numerical operations/calculations within the scope of this unit
- codes, standards, legislative or regulatory requirements applicable to the measuring equipment and/or calibration
- procedures for initiating the calibration of measuring equipment
- the physical reference standard against which the measuring equipment is to be calibrated
- procedures for calibrating measuring instruments
- tools and equipment required to calibrate measuring equipment
- procedures for recording calibration details
- the reasons for keeping calibration records
- the procedures to be followed when measuring equipment is found to be out of calibration
- the reasons for checking results from out of calibration measuring equipment
- procedures for reporting out of calibration measuring equipment
- hazards and control measures associated with inspection, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform inspection (advanced). Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and**

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing inspection (advanced) or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Quality
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## MEM15007B Conduct product and/or process capability studies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers conducting process capability studies, setting control limits and selecting sampling plans.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the analysis of data from a production section or processes using appropriate statistical techniques. Consultation may be required with production or process personnel and is undertaken within the enterprise's total quality plan.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations

Prerequisite units		
	MEM15001B	Perform basic statistical quality control
	MEM15008B	Perform advanced statistical quality control

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Conduct process capability studies	<p>1.1.Procedure for conducting capability study is determined.</p> <p>1.2.Instructions for personnel conducting trial run are prepared.</p> <p>1.3.Data from trial run is analysed and the process capability is calculated.</p> <p>1.4.Possible number of product defects from a particular process is estimated.</p> <p>1.5.Optimum target mean to suit process capability data is determined.</p> <p>1.6.Reports listing various options from process capability studies are prepared.</p>

ELEMENT	PERFORMANCE CRITERIA
	1.7.Design specifications based on an analysis of data are recommended.
2. Set control limits	2.1.Control limits for sample/subgroup average, range and standard deviation are calculated. 2.2.Warning limits for subgroup average, range and standard deviation are calculated. 2.3.Course of action resulting from out of control situation is determined and documented to standard operating procedures.
3. Select sampling plans	3.1.Appropriate sampling plan to suit production schedule is selected and acceptable quality limits are determined, taking into account specified producer and consumer risks. 3.2.Sampling plan is documented including implementation strategy.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- collecting and collating data
- analysing data, identifying solutions and developing recommendations
- preparing reports listing the various options identified from the process capability study
- determining process design specifications from process capability data
- documenting sampling plan and implementation strategy

#### Required knowledge

Look for evidence that confirms knowledge of:

- the process to be studied
- the procedures for conducting process capability studies
- the data used to calculate the process capability
- the procedures for estimating the possible number of product defects
- options for improving the process and benefits of each

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for determining the optimum target mean
- the procedures for setting control limits
- numerical operations and calculations/formulae for process capability, control limits and other outcomes within the scope of this unit
- the procedures for setting warning limits
- the concept of 'out of control' situations
- the action to be taken when an 'out of control' situation is detected
- the procedures for documenting 'out of control' situations
- the acceptable level of quality
- a variety of sampling plans and their application
- the sampling plan to be applied to a given situation
- the reasons for selecting the chosen plan
- the acceptable quality limits
- the risks associated with identifying acceptable quality limits for the producer and customer
- the procedures for documenting and implementing sampling plans
- hazards and control measures
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to conduct product and/or process capability studies. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with conducting product and/or process capability studies or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Procedure</b>	Frequency of sample, sample size
<b>Data</b>	From periodic samples drawn from a trial run of the process
<b>Process capability</b>	The natural tolerance of the process which may be calculated at 3 sigma/standard deviations
<b>Product defects</b>	From a consideration of 3 or 6 sigma standard deviations compared to specification requirements etc.
<b>Various options</b>	Adjustment of process to move average; improvements to reduce process capability; changes to reduce assignable causes
<b>Appropriate sampling plan</b>	Plans within the adopted quality system, sample size, frequency of sample etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Quality
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## MEM15008B Perform advanced statistical quality control

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers constructing control charts.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit involves the understanding of statistical processes and the application of these processes to the maintenance and improvement of a quality system.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM15001B	Perform basic statistical quality control



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Construct control charts	<p>1.1.The key product parameters to be controlled are determined.</p> <p>1.2.Control charts/proformas including the determination of control limits from sample data are completed.</p> <p>1.3.1, 2 and 3 sigma limits are used to measure and describe population dispersion as required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- constructing control charts, including determining control limits from sample data

**REQUIRED SKILLS AND KNOWLEDGE**

- identifying the key parameters to be controlled from a given specification
- calculating the population dispersion for given data in terms of 1, 2 and 3 sigma limits

**Required knowledge**

Look for evidence that confirms knowledge of:

- procedures for constructing control charts and determining control limits from sample data
- population dispersion in terms of 1, 2 and 3 sigma limits
- safe workplace practices

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform advanced statistical quality control. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with performing advanced statistical quality control or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Product parameters</b>	Dimensions, weights, voltages, temperatures, speeds etc.
<b>Control charts/proformas</b>	Shewart Charts or charts for process average, range, or attributes etc.
<b>Sample data</b>	Periodic samples drawn from a trial run of the process

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Quality
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## MEM15010B Perform laboratory procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers working under laboratory conditions, performing calibration of equipment and writing reports on the results.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the use of a range of sophisticated equipment that provides independent feedback on quality processes and procedures.</p> <p>Individuals are likely to be working autonomously and following scientific procedures under controlled conditions. All work would be carried out to predetermined standard operating procedures.</p> <p>This unit would be taken in conjunction with appropriate technical units.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Work under laboratory conditions	1.1.Independent tests are conducted under controlled conditions.
2. Perform calibration	2.1.Equipment is verified and calibrated to agreed quality standards. 2.2.Calibration status is safeguarded against unauthorised adjustment. 2.3.Accurate records are kept for reference purposes. 2.4.Test equipment is periodically recalled for adjustment, repair and re-calibration. 2.5.Documentary evidence is maintained, covering identification of equipment; frequency of re-calibration; calibration status and procedures for recall, handling and storage, adjustment, repair,

ELEMENT	PERFORMANCE CRITERIA
	<p>calibration, installation and use.</p> <p>2.6. Calibration to reference standards of known accuracy such as national or international standards is traced, or where these do not exist, is set to specifically developed criteria.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading and interpreting relevant drawings, circuits, specifications, instructions and data in accordance with standard operating procedures
- planning and sequencing operations
- checking and clarifying task-related operations
- using calculations and numerical operations within the scope of this unit
- conducting independent tests under controlled conditions
- checking measuring equipment for correct calibration against the agreed quality standards
- safeguarding the calibration status of the equipment against unauthorised adjustment
- completing and maintaining records of measuring equipment calibrated
- recalling test equipment for adjustment, repair and re-calibration
- using reference standards or specific criteria as the basis for calibration.
- documenting test results
- preparing reports on the tests carried out
- conducting inspections, tests and audits in accordance with standard
- using results of inspections, tests and audits to inform the design and service

#### Required knowledge

Look for evidence that confirms knowledge of:

- the tests to be undertaken
- the conditions under which the tests are to be undertaken
- the testing procedures to be followed
- the reasons for conducting tests under controlled conditions

**REQUIRED SKILLS AND KNOWLEDGE**

- the need for tests to be conducted independently
- the quality standards against which the measuring equipment is to be calibrated
- the correct operation of the measuring equipment
- the specifications of the measuring equipment
- the tools and equipment required to check the calibration of the measuring equipment
- the procedures for checking the calibration of the measuring equipment
- any codes, standards, legislative or regulatory requirements applicable to the measuring equipment and/or calibration
- the procedures for preventing unauthorised adjustment of equipment
- the reasons for protecting equipment against unauthorised adjustment
- the records to be kept with respect to the calibration of measuring equipment
- the reasons for keeping accurate calibration records
- the procedures for recalling test equipment for adjustment, repair and re-calibration
- the frequency of test equipment recall
- the reasons test equipment may be recalled
- all relevant documentation relating to the calibration/re-calibration of test equipment
- the procedures for completing the relevant documentation
- sources of reference standards and procedures to be used in the absence of reference standards
- the reports to be prepared/provided with respect to the test equipment being tested
- the procedures for preparing/ providing reports on tests carried out on test equipment
- the auditing processes to be applied to testing procedures
- the use of information from the inspections, tests and audits conducted in the development of design and servicing of products/equipment
- hazards and control measures associated with performing laboratory procedures, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.



<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform laboratory procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing laboratory procedures or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Tests</b>	<p>Tests will be conducted to a standard method and may be:</p> <ul style="list-style-type: none"> <li>• mechanical tests such as for hardness, tensile and impact</li> <li>• electrical tests such as for resistance, capacitance and inductance</li> <li>• semiconductor or other electronic tests</li> </ul>
<b>Calibration</b>	<p>Calibration refers to those calibrations which are conducted to a specified standard using equipment available in the workplace/laboratory. It may include the testing of known standard samples</p>
<b>Test equipment</b>	<p>May be mechanical, electrical or electronic or some combination</p>
<b>Documentary evidence</b>	<p>Documentary evidence of calibration will be sufficient to satisfy the needs the certifying body (e.g. NATA) or as otherwise specified in the calibration standard or in accordance with manufacturers' recommendation</p>
<b>Documented</b>	<p>Documentation of test/calibration results will conform to good laboratory practice and will allow for the verification of results and for a historical record of results such as might be required for verification of results, quality audits and legal inquiries.</p>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Quality
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## MEM15011B Exercise external quality assurance

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers liaising with external suppliers, checking for conformance to specifications, assessing the external suppliers and evaluating their goods and/or services.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to evaluating and communicating with a wide range of supplier enterprises to ensure that purchased supplies meet quality standards and that adequate documents are prepared and maintained to standard operating procedures.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM15004B	Perform inspection
	MEM15005B	Select and control inspection processes and procedures

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Liaise with external suppliers	1.1.The exact quality requirements are communicated to suppliers. 1.2.Quality assurance system is negotiated and agreed. 1.3.Verification method and systems and procedures for dispute settlement are established and agreed. 1.4.Recording system of procured products or services which ensures traceability is established.
2. Check for conformance to specifications	2.1.The requirements of all relevant documentation including contract specifications, drawings and purchase orders are obtained and understood. 2.2.The conformance of the procured product or service to all of the documented requirements is established.
3. Assess external suppliers	3.1.Assessment and evaluation of suppliers' capability and/or quality system are conducted. 3.2.Suppliers' goods or services are evaluated.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating quality requirements to the supplier
- negotiating quality assurance system
- implementing system for recording and tracing products or services procured
- obtaining and interpreting relevant drawings, specifications, documentation etc.
- checking products/materials or services provided for conformance to documented requirements/ specifications
- assessing supplier capability to provide the required product/material or service
- evaluating supplier quality systems
- evaluating supplier goods or services
- using communication and conflict resolution

#### Required knowledge

Look for evidence that confirms knowledge of:

- the exact quality requirements of the product/material to be supplied
- the procedures to be followed to ensure the supplier understands the quality requirements
- the requirements of a quality assurance system to ensure the supplied product/material conforms to the quality requirements
- the procedures for negotiating agreements with suppliers
- the procedures for verifying that the agreed quality assurance system is being utilised by the supplier
- techniques for dispute resolution
- the procedures for recording procured products or services
- the means of tracing procured products or services
- the reasons for tracing procured products or services
- the specifications of the product/material to be supplied or service to be provided
- any variations from documented requirements/ specifications
- the procedures for assessing/evaluating a supplier's capability to supply the required product/material or service
- the procedures for evaluating a supplier's quality system
- the procedures for evaluating a supplier's goods or services
- any equipment and techniques required to carry out the evaluation procedures
- hazards and control measures within the scope of this unit
- use and application of personal protective equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to exercise external quality assurance. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with exercising external quality assurance or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not

<b>EVIDENCE GUIDE</b>	
	require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Quality assurance system</b>	ISO 9000 procedures, Six Sigma procedures, sampling plans of all kinds etc.
<b>Traceability</b>	Unique identification of individual product or batches as appropriate
<b>Assessment and evaluation</b>	Vendor rating procedures, design reviews, audit reports, site surveillance reports, failure reports and concession applications etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Quality
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## MEM15012B Maintain/supervise the application of quality procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers improving the quality system, and collecting and summarising data to support the quality improvement process.
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### Application of the Unit

<b>Application of the unit</b>	<p>The data would be used to produce statistical information such as averages and ranges, and charts such as tally, run or control charts.</p> <p>This unit applies to the standards that are applicable to the supervision or maintenance of a quality improvement system either individually or in a team situation.</p> <p>The definition of customer is wide and applies to the next person or organisation receiving the product or service.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM15001B	Perform basic statistical quality control

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Improve quality system	1.1.Specifications to meet customer needs (internal and external) are interpreted. 1.2.Leadership role as a supplier is undertaken to ensure quality within the supply chain.
2. Collect and summarise data	2.1.Data is recorded and interpreted accurately in accordance with standard operating procedures. 2.2.Data is used to produce relevant statistical information, for example, average and range or the production of charts such as tally, run or control

ELEMENT	PERFORMANCE CRITERIA
	charts.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting the specifications of the product or service to be provided
- communicating effectively with suppliers and customers
- recording data collected
- calculating relevant statistical information from collected data
- producing tally, run and control charts from collected data
- using leadership skills
- using analysis skills

#### Required knowledge

Look for evidence that confirms knowledge of:

- specifications to be achieved in providing the service or producing the product
- the team's supplier(s) and customer(s)
- the possible effects of supplying products and/or services to customers that do not comply with specifications
- the procedures to be followed in producing the product and/or supplying the service
- the checks to be undertaken to ensure the product/service complies with specifications
- the personnel responsible for the quality of the product/service provided
- the actions to be taken when a non-conformance to specifications is detected and reasons for taking those actions
- the procedures for recording data collected
- the possible trends from the collected data
- the actual trends indicated by given samples of data
- the reasons for collecting data
- the statistical information to be calculated
- the use of statistics in interpreting production data

**REQUIRED SKILLS AND KNOWLEDGE**

- the functions of tally, run or control charts in representing production data
- the trends indicated by the statistical information calculated and/or the charts produced
- the action to be taken in response to any trends identified
- the reasons for taking proposed action
- appropriate techniques, tools and equipment to measure machined components
- hazards and control measures within the scope of this unit
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain/supervise the application of quality procedures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

<b>EVIDENCE GUIDE</b>	
	with maintaining/supervising the application of quality procedures or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Customer needs</b>	<ul style="list-style-type: none"> <li>• Product</li> <li>• Service</li> <li>• Delivery and distribution</li> <li>• Quality</li> <li>• Quantity</li> <li>• Price</li> <li>• Communication and documentation</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Quality
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## MEM15015B Examine trading practices

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers examining trading practices relating to measurement employed by traders.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement inspection activities in public or private enterprises.</p> <p>This unit applies to the examination of sales made by reference to measurement.</p> <p>It does not apply to inspection of pre-packed articles.</p> <p>For inspection of pre-packed articles, Unit MEM15016B (Inspect pre-packed articles) should be selected.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 5</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Explain the requirements of trade measurement legislation relating to trading practices	1.1.Legislation requirements that apply to trading practices are explained. 1.2.Policy guidelines that apply to trading practices are explained.
2. Inspect trading practices for compliance	2.1.Trading practice methods employed on premises are examined for compliance with legislative requirements. 2.2.Incidents of non-compliance in a range of trading environments are identified and, where appropriate, activities are undertaken to prove the breach of legislation. 2.3.Results of inspection are documented.

ELEMENT	PERFORMANCE CRITERIA
3. Finalise inspection and identify appropriate action	<p>3.1.Trading practice information relevant to the inspection is communicated to the trader.</p> <p>3.2.Appropriate actions to encourage compliance are determined and identified.</p> <p>3.3.Inspection documentation is completed in accordance with organisational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- applying relevant organisational policy and procedures in regard to trading practices
- examining methods utilised for advertising and the sale of goods employed on the premises for compliance with legislative requirements
- examining the manner in which a measuring instrument is used on the premises
- identifying incidents of non-compliance in a range of trading environments
- determining action to be undertaken based on the organisation's enforcement policy
- gathering sufficient and relevant evidence to prove a breach
- accurately recording information
- advising on appropriate trading practices to assist compliance
- undertaking observation and surveillance in relation to trading practices
- explaining legislative requirements and obligations
- completing notices accurately in accordance with organisational guidelines
- planning follow-up activities as required
- accurately recording results of the inspection and recommendations in the organisation's information files
- completing breach reports in accordance with organisational guidelines

#### Required knowledge

Look for evidence that confirms knowledge of:

- definition of the term 'trading practices'
- relevant policy and procedures across a range of trading environments
- legislation relating to trading practices

**REQUIRED SKILLS AND KNOWLEDGE**

- the range of trading environments
- trading practices relevant to a range of business types
- processes for evidence collection and evidence handling
- specific reporting procedures
- techniques to liaise with traders
- legislative requirements and obligations for the issuing of notices
- organisation's policy guidelines for return visits
- specific reporting procedures
- types of evidence

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to examine trading practices involving measurement employed by traders. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with examining trading practices employed by traders, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Legislation requirements and policy guidelines</b>	Enabling legislation, organisational procedures and policies - workplace, health and safety, enforcement policies
<b>Trading practices</b>	Methods of sale of goods, advertising, use of measuring instrument, position of measuring instruments, misrepresentations, environmental factors, suitability of instrument, over-pricing, incorrect measurement

<b>RANGE STATEMENT</b>	
<b>Premises</b>	Supermarkets, fruit and vegetables retailers, packing house, meat, seafood and smallgoods, bakery, etc.
<b>Examination for compliance</b>	Observation, trial purchase, questioning, reviewing records
<b>Activities used to prove a breach of legislation</b>	Trial purchases, observation/surveillance, photographs, seizure of documentations, articles, measuring instruments, testing the measuring instruments
<b>Appropriate actions to encourage compliance</b>	Warning letter, non-compliance notice, infringement notice, prosecution

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Quality
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## MEM15016B Inspect pre-packed articles

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit cover performing trade measurement inspection activities in trading environments. The unit covers the competency required to undertake examination of pre-packed articles in relation to measurement.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the inspection of articles intended for sale as pre-packed articles for compliance with legislative requirements.</p> <p>Applies to goods sold or intended for sale in any location regardless of place of packing.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Explain the requirements of trade measurement legislation relating to pre-packed articles	<p>1.1.Legislative requirements that apply to pre-packed articles are explained.</p> <p>1.2.Approved markings as they apply to all pre-packed articles intended for sale are described.</p>
2. Inspect pre-packed articles for compliance with marking requirements	<p>2.1.Pre-packed articles are examined for the marking of quantity statements and unit pricing in accordance with legislative requirements.</p> <p>2.2.Pre-packed articles are examined for the marking of packer identification.</p> <p>2.3.Results of examination are documented for further action.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Measure pre-packed articles	<p>3.1. Articles are selected for check measuring in accordance with marketplace intelligence, legislative requirements and organisational procedures.</p> <p>3.2. Product handling and disposal requirements are assessed and complied with in accordance with workplace, health and safety requirements, environmental considerations and public sector auditor's requirements.</p> <p>3.3. Specialised equipment and measuring devices are selected in accordance with organisational procedures.</p> <p>3.4. Articles are check measured in accordance with organisation's procedures to determine compliance with legislation.</p> <p>3.5. Results of check measurements are documented for further action.</p>
4. Finalise inspection and take appropriate action	<p>4.1. Trading practice information relevant to the inspection is communicated to the trader.</p> <p>4.2. Approved procedures to remedy non-compliance are determined and applied,</p> <p>4.3. Inspection documentation is completed in accordance with organisational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- applying relevant sections of the legislation to pre-packed articles
- measuring pre-packed articles
- assessing quantity and unit pricing statements, for compliance with legislation
- comparing marking of packer identification, against legislation
- recording marking non-compliance accurately for further action
- interpreting marketplace intelligence
- safely handling and disposing of products in relation to measuring pre-packed



## REQUIRED SKILLS AND KNOWLEDGE

articles

- documenting check-measurement results and non-compliances in accordance with organisational guidelines
- checking the accuracy and suitability of the measuring devices
- discussing trader's enquiries and concerns
- explaining legislative requirements to traders
- completing legal documentation
- planning follow-up activities
- recording results of the inspection accurately in organisation's information files
- making clear and accurate recommendations

### Required knowledge

Look for evidence that confirms knowledge of:

- definition of 'pre-packed articles'
- relevant sections of legislation across a range of pre-packed articles
- the range of packing types
- quantity statement or measurement marking form, size and position
- pre-packed articles exempted from the requirements of legislation
- all symbols for units of measurement
- application of qualifying statements
- pre-packed articles exempted from marking packer identification
- how to identify origin of packing
- marketplace intelligence, legislative requirements and organisational procedures in relation to selecting pre-packed articles
- the impact of environmental factors on pre-packed articles
- use of protective clothing and equipment
- checking of hazardous product data sheet
- the organisation's policy and procedures
- the accuracy and suitability of the measuring devices used to check pre-packed articles
- procedures for determining the measurement method of pre-packed articles
- the number of articles to check-measure in accordance with legislative requirements
- methods of determining the tare weight of packages
- responding to trader's enquiries
- advising the trader
- accurate wording of notices
- legislative requirements and obligations for the issuing of notices
- organisation's guidelines for return visits
- specific reporting procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to inspect pre-packed articles. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with inspecting pre-packed articles, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

<b>EVIDENCE GUIDE</b>	
	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislation requirements and policy guidelines</b>	Enabling legislation, organisational policies and procedures - workplace, health and safety, environmental legislation, enforcement policies, auditor's instructions
<b>Workplace, health and safety requirements</b>	Storage of test equipment, site/premise conditions, handling of dangerous materials, safety clothing, manual handling techniques, product disposal, transportation of test equipment
<b>Environmental considerations</b>	Disposal of hazardous materials, weather conditions, storage methods and conditions
<b>Specialist equipment and measuring devices</b>	Reference standards and test equipment, safety equipment, product handling equipment, measuring equipment
<b>Inspection documentation</b>	Organisational forms, notices, field books, product handling sheets, evaluation form or report

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Quality
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## MEM15017B Use and maintain reference standards

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers caring for and maintaining reference standards and test equipment used to undertake trade measurement activities.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement inspection/certification activities in public or private enterprises.</p> <p>This unit may be applied in relation to inspection of pre-packed articles, examining trading practices, auditing servicing licensees, investigating consumer complaints, performing verification/certification and in-service inspection.</p> <p>Reference material relevant to this competency includes Australian standards, handbook of verifying authority, manufacturers' operating manuals, organisational procedures and quality assured manual.</p> <p>Workplace and health and safety considerations include storage and transportation of test equipment, handling of test equipment, handling of hazardous materials, safety clothing, manual handling techniques and site/premises conditions.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 3</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM11011B	Undertake manual handling
	MEM12003B	Perform precision mechanical measurement
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12005B	Calibrate measuring equipment
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the appropriate class of reference standard suitable to verify a range of trade measuring instruments	<p>1.1.Tolerances required for reference standards are researched in relation to testing a range of trade measuring instruments and legislation.</p> <p>1.2.The correct classes of reference standards are selected to test a range of trade measuring instruments.</p>
2. Use reference standards and test equipment in a safe and metrologically sound manner	<p>2.1.Standards Laboratory purpose and function are explained.</p> <p>2.2.An operational assessment on reference standards and test equipment is performed prior to use.</p> <p>2.3.Documented operating policies and procedures for reference standards and test equipment are accessed and followed.</p> <p>2.4.Safety requirements for the use of reference standards and test equipment within the work environment are demonstrated.</p>
3. Store and transport reference standards and test equipment to maintain their integrity	<p>3.1.Specialised equipment and reference standards are stored in accordance with organisational procedures.</p> <p>3.2.Specialised equipment and reference standards are transported in accordance with organisational procedures.</p>
4. Perform required maintenance of reference standards and test equipment	<p>4.1.Maintenance requirements of reference standards and test equipment are identified.</p> <p>4.2.Regular maintenance of reference standards and test equipment is undertaken in accordance with maintenance register.</p> <p>4.3.Defective reference standards and test equipment are identified and reported for repair.</p>
5. Interpret documentation relating to the use of maintenance of reference standards and test equipment	<p>5.1.Information contained in the certificate of verification is checked and compared with reference standards and test equipment being used.</p> <p>5.2.Reference standards are used in accordance with documented instructions and certificates.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accessing correct reference manuals for appropriate information concerning tolerances for reference standards
- identifying correct class of reference standard and matching with the appropriate trade measuring instrument
- accessing documented operating procedures for reference standards and test equipment
- using reference standards and test equipment
- calibrating/maintaining reference standards and test equipment
- maintaining maintenance register
- identifying and recording/reporting malfunction of or damage to reference standards or test equipment
- interpreting certificates of verification in relation to the use of reference standards
- using graphs and tables within certificates

#### Required knowledge

Look for evidence that confirms knowledge of:

- definition of 'legal metrology'
- the hierarchy of reference standards in relation to legal metrology
- Australian legal units of measurement used for trade
- the organisations involved in legal metrology in Australia
- application of different classes of reference standards used to test measuring instruments
- maintenance requirements for reference standards and test equipment
- major function and purpose of the Standards Laboratory
- the actions to be taken if reference standards and test equipment are found to be defective
- test equipment and reference standards storage specifications and procedures
- personal responsibility for workplace, health and safety requirements
- specialised equipment, reference standards and transport specifications and procedures
- transport specifications and procedures
- variations from storage specifications and procedures requiring appropriate approval
- variations from transport specifications and procedures requiring appropriate approval



**REQUIRED SKILLS AND KNOWLEDGE**

- maintenance required for test equipment where manufacturers' requirements are unavailable
- a range of maintenance and calibration procedures
- procedure for reporting faults
- action to be taken where legal traceability can not be confirmed
- the purpose of certificates of verification issued under the national legislation
- information in graphs and tables within certificates
- workplace, health and safety requirements relating to reference standards and test equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to use and maintain reference standards. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

<b>EVIDENCE GUIDE</b>	
	with using and maintaining reference standards, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Reference standards</b>	Mass, volume, density, area, length, master meters, temperature
<b>Legislation</b>	Enabling legislation, workplace, health and safety, environmental legislation
<b>Operating policies and procedures</b>	Manufacturers' specifications, industry guidelines, Australian standards, legislation, organisational procedures and guidelines
<b>Specialised equipment</b>	Reference standards, measuring devices, safety equipment

**RANGE STATEMENT**

**Maintenance requirements of reference standards and test equipment**

Cleaning and painting, electrical safety testing and tagging, continuity and pressure testing, manufacturers' service requirements

**Unit Sector(s)**

**Unit sector**

**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

**Competency field**

Quality

## MEM15018B Investigate consumer complaints

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers the competency required to investigate consumer complaints in relation to measurement.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement inspection activities in trading environments.</p> <p>This unit applies to investigating consumer complaints such as those relating to pre-packed articles, use of measuring instruments, trading practices, servicing licensees and public weighbridges.</p> <p>Reference material includes uniform test procedures, international handbook, Australian standards and investigation method guidelines.</p> <p>Relevant workplace health and safety/environmental considerations are storage and transportation of test equipment, site/premises conditions, disposal of dangerous materials, storage of seized equipment/products, specific safety equipment and clothing, manual handling techniques, product handling equipment, and weather.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM11011B	Undertake manual handling
	MEM12023A	Perform engineering measurements
	MEM15004B	Perform inspection
	MEM15005B	Select and control inspection processes and procedures
	MEM15015C	Examine trading practices
	MEM15016B	Inspect pre-packed articles
	MEM16004B	Perform internal/external customer service
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Receive and document the complaint	<ul style="list-style-type: none"><li>1.1. Allegations are recorded in accordance with organisational procedures.</li><li>1.2. Complaints are screened to ensure that they are relevant to trade measurement and are assessed to determine priority.</li><li>1.3. Complainant is advised of investigative process and timeframes for feedback.</li></ul>
2. Plan the investigation	<ul style="list-style-type: none"><li>2.1. The information received is assessed for possible breaches in relation to the legislation.</li><li>2.2. Trader history and complaint precedence is researched.</li><li>2.3. Suitable equipment and personnel are organised to undertake the investigation.</li><li>2.4. Enforcement policies and procedures are researched to ascertain appropriate action to be implemented.</li></ul>
3. Investigate the complaint	<ul style="list-style-type: none"><li>3.1. Preliminary investigation to gather prima facie evidence is conducted in accordance with organisational procedures.</li><li>3.2. Evidence is gathered to substantiate a breach in accordance with investigative practices.</li><li>3.3. The relevant components of a routine field inspection are conducted in accordance with organisational procedures.</li></ul>
4. Finalise the complaint investigation	<ul style="list-style-type: none"><li>4.1. Information relevant to the inspection is communicated to the trader.</li><li>4.2. Approved procedures to remedy non-compliance are determined and applied.</li><li>4.3. Inspection documentation is completed in accordance with organisational procedures.</li></ul>
5. Complete complaint file documentation	<ul style="list-style-type: none"><li>5.1. Complainant is advised of outcome of the investigation.</li><li>5.2. Complaint documentation is completed in accordance with organisational guidelines.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accurately recording complaint details
- prioritising complaints and other related activities
- researching and applying relevant legislation to the complaint investigation
- accessing and using organisational information systems
- identifying and organising suitable equipment and personnel
- briefing personnel concerning the requirements of the investigation
- accessing the organisation's enforcement policies and procedures
- establishing appropriate courses of action
- conducting surveillance of trading premises is conducted
- gathering information to verify the complainant's allegations
- gathering evidence to prove all elements of a breach
- using appropriate investigative techniques are used
- maintaining the integrity of evidence
- responding to traders' concerns
- discussing traders' enquiries and concerns.
- explaining legislative requirements and obligations to the trader
- completing notices in accordance with organisational guidelines
- planning follow-up activities
- recording results of the inspection accurately in organisation's information files
- completing breach reports in accordance with organisational guidelines
- communicating outcomes of the investigation to the complainant within specified organisational timeframes
- applying interpersonal communication and listening skills
- accurately recording results of the investigation in the complaint file

#### Required knowledge

Look for evidence that confirms knowledge of:

- the different methods of complaint lodgements
- organisational policy guidelines concerning complaints
- organisational guidelines in regard to timelines
- the equipment required to investigate a range of complaints
- the organisation's guidelines for the deployment of personnel
- the range of possible investigation activities available
- elements of offence

**REQUIRED SKILLS AND KNOWLEDGE**

- available surveillance methods for a range of complaints and premises
- the evidence required to prove a range of breaches of legislation
- a range of investigation methods
- the required procedures for the handling of evidence to maintain its integrity
- the reasons for selecting relevant components of a routine field inspection
- legislative requirements and obligations for the issuing of notices
- organisation's policy guidelines for return visits
- specific reporting procedures
- complaint outcome classifications
- complaint documentation procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to investigate consumer complaints. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,



<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with investigating consumer complaints, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Organisational procedures</b>	Trial purchase, surveillance, witness statements, verification/in-service inspection procedures, pre-packed articles inspection procedures, trading practices inspection procedures, routine field inspection procedures
<b>Complaints</b>	Measuring instruments, pre-packed articles, trading practices, servicing licensees, public weighbridge licensees, fair trading matters relating to trade measurement

RANGE STATEMENT	
Sources of information	Business/company details, organisational database, searches from other government agencies
Legislation	Enabling legislation, workplace, health and safety, environmental legislation, enforcement policies
Equipment	Reference standards, test equipment, safety equipment
Documentation	Organisational forms, notices, field books, product handling sheets, educational material/brochures

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Quality
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## MEM15019B Conduct a field inspection

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers conducting a trade measurement field inspection on trader's premises.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement inspection activities in trading environments. It may be applied to trade measurement inspections involving pre-packed articles, auditing servicing licensees, public weighbridges, investigating consumer complaints, examining trading practices, performing verification/certification and in-service inspection. Relevant legislation/policies include enabling legislation, uniform test procedures, organisational policies and procedures, workplace, health and safety and enforcement policies.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM11011B	Undertake manual handling
	MEM12003B	Perform precision mechanical measurement
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12005B	Calibrate measuring equipment
	MEM12023A	Perform engineering measurements
	MEM13003B	Work safely with industrial chemicals and materials
	MEM15004B	Perform inspection
	MEM15005B	Select and control inspection processes and procedures
	MEM15015C	Examine trading practices
	MEM15016B	Inspect pre-packed articles
	MEM15017C	Use and maintain reference standards
	MEM15018B	Investigate consumer complaints
	MEM16002C	Conduct formal interviews and negotiations
	MEM16004B	Perform internal/external customer service
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Develop a work plan to conduct field inspections	<p>1.1.Traders are identified for inspection in accordance with organisational priorities.</p> <p>1.2.Routine field inspections are scheduled to complement other inspection activities whilst maximising organisational efficiencies and effectiveness.</p> <p>1.3.Appropriate equipment is identified and accessed.</p> <p>1.4.Specific inspection arrangements are made with the trader.</p> <p>1.5.Relevant reference and/or technical information and trader history is researched.</p>
2. Maintain test equipment during a field inspection	<p>2.1.Test equipment is transported in accordance with manufacturers' specifications and organisational procedures.</p> <p>2.2.Test equipment is operated within manufacturers' specifications and organisational procedures.</p> <p>2.3.Failures and repairs of test equipment are reported in accordance with organisational procedures.</p>
3. Conduct initial on-site assessment of the trading premises	<p>3.1.Surveillance of the trading premises is undertaken to evaluate the trading practices in use.</p> <p>3.2.Officer establishes their identity with the trader or responsible person and explains the purpose of the</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>inspection.</p> <p>3.3. Local workplace, health and safety issues relevant to the premises are identified and appropriate action is taken to comply.</p> <p>3.4. Measuring instruments used for trade are identified and the inspection is planned with minimal disruption to the trader.</p> <p>3.5. Locations for product return or disposal are identified for later use.</p>
4. Inspect instruments and/or trading practices	<p>4.1. Measuring instruments are selected for inspection in accordance with organisational guidelines.</p> <p>4.2. Test equipment is used in accordance with organisational procedures taking into consideration workplace health and safety factors.</p> <p>4.3. Relevant test procedures for verification and in-service inspection are conducted in accordance with organisational procedures.</p> <p>4.4. Inspection of pre-packed articles is conducted in accordance with organisational procedures.</p> <p>4.5. Trading practices are identified and action is taken to remedy any non-compliance.</p>
5. Undertake an investigation where a breach is detected	<p>5.1. Evidence relating to the breach is gathered.</p> <p>5.2. Trader and witnesses are interviewed for supporting evidence.</p> <p>5.3. Chain of evidence is maintained.</p>
6. Complete documentation for inspection	<p>6.1. Instrument and trader information is recorded accurately for the organisation's information system.</p> <p>6.2. Inspection documentation is completed in accordance with organisational procedures.</p>
7. Advise trader of inspection outcomes	<p>7.1. The trader is advised of instrument test, pre-packed article and trading practice results where appropriate.</p> <p>7.2. The trader's enquiries and concerns are discussed.</p> <p>7.3. Legislative requirements, obligations and possible corrective solutions are explained to the trader where appropriate.</p> <p>7.4. The trader is advised of reporting procedures and possible outcomes for any detected breaches.</p> <p>7.5. Follow-up activities are planned if required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accessing and interrogating organisation's information system for relevant trader information
- researching and collecting information
- scheduling inspection activities
- identifying priorities and their integration into routine field inspections
- being aware of the operational needs of the trader
- selecting instruments for tests
- completing calibration/repairs
- evaluating information gathered during surveillance to identify non-compliance
- conducting surveillance of trading premises
- using the organisation's identification procedure (e.g. ID card)
- explaining the purpose of the inspection to the trader
- obtaining workplace, health and safety information specific to the trading environment
- recording data plate information and instrument errors
- monitoring sales transactions
- assessing advertising used on or outside the premises
- identifying incorrect trading practices
- gathering evidence to prove a breach
- preparing interview questions to cover all elements of an offence
- using assertive communication and active listening

#### Required knowledge

Look for evidence that confirms knowledge of:

- the organisation's inspection priorities
- options for dealing with conflicting priorities
- a range of equipment used for trade measurement field inspections
- alternative contact arrangements
- a range of environmental factors that impinge on measuring instruments
- criteria for selecting instruments
- test equipment transportation specifications and procedures
- variations from transport specifications and procedures requiring appropriate approval
- variations from operating specifications and procedures requiring appropriate

## REQUIRED SKILLS AND KNOWLEDGE

approval

- types of failure that might occur and possible remedies in a range of test equipment
- preventative work practices/maintenance to keep equipment in good working order
- methods of surveillance
- legislative requirements for the inspection
- personal responsibility for workplace, health and safety
- workplace, health and safety issues relating to a range of occupational and business environments
- contingencies to facilitate minimal disruption to the trader
- action that would be taken if incorrect disposal occurs
- research methods used to determine instrument performance trends
- workplace, health and safety requirements for a range of test procedures and working environments
- a range of environmental and operational factors that may adversely influence the accuracy of instruments, and action required to remedy their effect
- organisational guidelines for the selection of pre-packed articles for inspection
- a range of non-compliance issues for trading practices
- strategies used to prove breaches of trading practices including trial purchases
- the format and procedure for conducting an interview in accordance with organisational guidelines
- the principles of natural justice; requirements of appropriate legislation; judges' or court rules; the organisation's code of conduct
- strategies for handling conflict
- cultural and gender issues that influence the communication/interviewing process
- maintenance of evidence integrity
- recording and secure storage of evidence in accordance with organisational procedures can be explained.
- types of ownership entities for legal responsibilities
- appropriate forms used for inspection outcomes including non-compliance and rejection notices, instrument performance records, fees and traders' files
- suitable environment to communicate inspection outcomes with trader
- strategies for handling conflict situation
- sensitivity to cultural and gender issues that influence the communication process
- corrective solutions for a range of scenarios
- legislative requirements for a range of trading environments
- reporting processes and outcomes
- accurate interpretation of enforcement guidelines
- methods for conducting a follow-up activity



## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to conduct a field inspection. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with conducting a field inspection, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Technical information and trader history**

Organisation's databases, business/company details

**Trading practices**

Advertising, over the counter sales, correct use of measuring instruments, method of sale of goods, positioning of instruments, environmental factors, suitability of instrument, over-pricing, incorrect measurement

**Test equipment**

Specific test equipment, reference standards, safety equipment, product handling equipment

**Workplace, health&safety**

Storage of test equipment, site/premises conditions, disposal of dangerous materials, storage of seized equipment, specific safety equipment and clothing

**Non-compliance**

Short measure, over-pricing, incorrect marking of packages

**Documentation**

Organisational forms, notices, field books, evaluation form or report, fees, servicing licensee forms, educational material/brochures

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Quality
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## MEM15020C Perform verification/certification or in-service inspection

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers testing a range of measuring instruments used for trading activities.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement inspection/certification activities in public or private enterprises.</p> <p>This unit applies to the legal verification/certification or in-service inspection of measuring instruments used for trading activities.</p> <p>This unit may be applied to the inspection of trade measuring instruments, such as those used for measuring pre-packed articles, and direct and/or indirect trading to the public.</p> <p>Relevant reference material includes NSC certificates of approval, manufacturers' product specifications, Australian standards, WHS legislation, uniform test procedures, organisational procedures and guidelines, and certificates of verification.</p> <p>Where work requires measuring instruments of a lower level of complexity and range and lower scope relating to uniform test procedures, reference material etc., Unit MEM15004B (Perform inspection) or Unit MEM15005B (Select and control inspection processes and procedures) should be selected as appropriate.</p> <p>If use and maintenance of reference standards is required, Unit MEM15017C (Use and maintain reference standards) should also be selected.</p>
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	<b>Band: B</b> <b>Unit Weight: 12</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM11011B	Undertake manual handling
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Describe the design and application of basic components in trade measuring instruments	<p>1.1.The fundamental operating features for a range of measuring instruments are identified.</p> <p>1.2.The purpose of major components within the range of measuring instruments is described.</p>
2. Determine the type of inspection required for a range of measuring instruments	<p>2.1.Instrument is assessed to determine whether a verification/certification or in-service tolerance is to be applied for inspection.</p> <p>2.2.The processes required for both the verification/certification and in-service of a range of measuring instruments are explained.</p> <p>2.3.Appropriate tolerances are identified for the determined inspection.</p>
3. Perform inspection of measuring instruments to determine compliance	<p>3.1.The operating environment of the instrument is analysed and monitored to determine its impact on the instrument.</p> <p>3.2.Sources of any possible operational error in the use of measuring instruments/systems are identified.</p> <p>3.3.Specialised equipment is selected and used in the prescribed manner for the inspection.</p> <p>3.4.Inspection of measuring instrument is conducted in accordance with appropriate test procedures, legislation and policies, and workplace, health and safety considerations.</p>
4. Finalise inspection and take appropriate action	<p>4.1.The appropriate action to be undertaken is determined and implemented.</p> <p>4.2.Performance trends of particular models of measuring instruments are identified and reported.</p> <p>4.3.The information is recorded in the organisation's information system.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- examining instruments for existing verification/certification marks
- identifying operational errors relevant to the type of instrument being tested
- selecting and correctly using the test equipment
- testing measuring instruments
- preparing technical reports relating to verification/certification or in-service inspection
- completing files

### Required knowledge

Look for evidence that confirms knowledge of:

- the major components and functions of an instrument
- the purpose of major components and functions of an instrument
- differences in the application of tolerances being applied
- process variations between verification/certification and in-service inspection
- appropriate tolerances for a range of measuring instruments
- environmental factors that may not result in an instrument rejection but other remedial actions
- specialised equipment that may be required from other organisations
- the action to be taken where a conflict occurs between uniform test procedures and those test procedures contained in certificates of approval
- removal of verification/certification marks is impractical on some instruments and the appropriate action to be taken in these circumstances
- methods to monitor performance trends

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform verification/certification or in-service inspection. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing verification/certification, or in-service inspection or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different



**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Range of measuring instruments</b>	Length of measures and measuring instruments, area measuring instruments, measures of volume, liquor measuring instruments, liquid measuring instruments, weighing instruments, milk tanks, vehicle tanks, liquefied gas flow meters, electronic metering systems, natural gas flow meters, dimensional measuring instruments, supplementary measuring instrument, auxiliary devices
<b>Monitoring</b>	Specific test equipment, random inspections, surveillance, complaint inspection, comparison/analysis of data over time, collation of statistical information, auditing of servicing licensees
<b>Specialised equipment</b>	Reference standards, safety equipment, product handling equipment, test equipment, specialised test equipment vehicles
<b>Legislation and policies</b>	Enabling legislation, organisational policies and procedures, workplace, health and safety, environmental legislation, enforcement policies, conditions of licence
<b>Workplace, health and safety considerations</b>	Storage and transportation of test equipment, site/premises conditions, specific safety equipment and clothing, manual handling techniques
<b>Recording documentation</b>	Non-compliance notices, reflect/incorrect notices, fees, organisational reporting forms

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Quality
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## MEM15021C Conduct audits of servicing licensees and public weighbridge licensees

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers auditing the work undertaken by servicing licensees/certifiers and the operations undertaken by public weighbridge licensees.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is designed for those performing trade measurement audits on public and/or private trade measurement licensees.</p> <p>This unit applies to personnel working for or appointed by a trade measuring administering authority. It encompasses audits of measuring instruments and documentation supplied by licensee, such as instrument accuracy, instrument markings, and adherence to legislative requirements and test procedures.</p> <p>Reference material includes uniform test procedures, inspector handbook, NSC certificates of approval, and organisational procedures and guidelines.</p> <p>Workplace, health and safety considerations include storage of test equipment, site/premises conditions, manual handling techniques, and specific safety equipment and clothing.</p> <p>If use and maintenance of reference standards is required, Unit MEM15017C (Use and maintain reference standards) should also be selected.</p> <p>If verification/certification is required, Unit MEM15020C (Perform verification/certification or in-service inspection) should also be selected.</p>
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	<b>Band: B</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM11011B	Undertake manual handling
	MEM16004B	Perform internal/external customer service
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Explain the licensing system for servicing licensees and public weighbridges	1.1. Major components of the licensing system for certification of measuring instruments are described. 1.2. Major components of the licensing system for public weighbridges are described. 1.3. The requirements for issuing servicing and public weighbridge licences in accordance with legislation and organisational policies/ procedures are described.
2. Identify measuring instruments for audit of certifiers	2.1. Servicing licensee's documentation is monitored for compliance with organisational requirements. 2.2. Organisational procedures are used to generate a list of measuring instruments to be audited.
3. Conduct performance audits on certifiers	3.1. Inspection of measuring instruments is performed to determine compliance in accordance with legislation and organisational procedures. 3.2. The certifier's procedures and documentation are assessed to ensure legislative requirements are met. 3.3. Results of audit are recorded in the organisation's information system. 3.4. Action required to remedy non-compliance is determined and applied.
4. Examine public weighbridge licensee's operations for compliance with legislation	4.1. Licensee's documentation is assessed for compliance with legislation and organisational requirements. 4.2. The operator's ability to undertake public weighbridge duties is observed for compliance with legislation. 4.3. Action required to remedy non-compliance is determined and applied.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

## REQUIRED SKILLS AND KNOWLEDGE

- evaluating servicing licensee's documentation for completeness of information
- monitoring lodgement of servicing licensee's documentation
- selecting instruments for auditing
- scheduling audits
- testing measuring instruments
- recording instrument errors
- assessing the certifier's documentation for accuracy against the instrument certified and legislative requirements
- completing audit reports
- determining and implementing appropriate remedial action
- assessing licensee's documentation for accuracy against the public weighbridge instrument certified and legislative requirements
- assessing signage, certificates and public weighbridge tickets for accuracy
- evaluating the operator's ability to perform the duties of a public weigher
- investigating and reporting detected breaches

## Required knowledge

Look for evidence that confirms knowledge of:

- major components of the licensing system for certification of measuring instruments such as legislative requirements, eligibility, conditions of licence including provision of competent employees, provision of reference standards, use of test procedures, and use of reporting documentation and quality assurance systems
- major components of the licensing system for public weighbridge such as legislative requirements, eligibility, conditions of licence including provision of competent employees, maintaining accuracy of the public weighbridge, weighing methods and obligations, and use of reporting documentation
- the process for issuing servicing and public weighbridge licences, specifically the activities undertaken by trade measurement personnel
- the process for handling incomplete forms
- inspection variations between verification inspection and an audit inspection
- reporting variations for a range of instruments
- requirements to complete a public weighbridge ticket
- methods to complete a public weighbridge ticket
- requirements for authority to operate a public weighbridge
- duties of operator of public weighbridge
- options to remedy non-compliance

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to conduct audits of servicing licensees and public weighbridge licensees. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with conducting audits of servicing licensees and public weighbridge licensees, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Legislation and organisational policies/procedures</b>	Enabling legislation, workplace, health and safety practices, organisational policies and procedures, licensing conditions, enforcement policies
<b>Documentation</b>	Application forms, certification forms, non-compliance forms, public weighbridge tickets, documents as specified by legislation, educational material/brochures, batch test histograms

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		



## Competency field

Competency field	Quality
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## MEM15022B Verify reference standards

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers verifying reference standards used for legal purposes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to those performing verification of reference standards in a verifying authority organisation. It would mainly occur under laboratory conditions.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement

<b>Prerequisite units</b>		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the categories and levels of verification for reference standards	1.1.The categories of reference standards that the organisation is authorised to verify are identified. 1.2.The classes of reference standards required to verify a range of standards are identified. 1.3.Tolerances for a range of reference standards are identified. 1.4.Tolerances for a range of reference standards are described.
2. Maintain suitable environmental conditions to facilitate verification of reference standards	2.1.Reference standard details are recorded in accordance with organisational guidelines. 2.2.Sources of possible operational procedures errors in the verification of reference standards are identified. 2.3.Required atmospheric conditions for the verification

ELEMENT	PERFORMANCE CRITERIA
	<p>of a range of reference standards are applied.</p> <p>2.4.Environmental conditions are assessed to determine whether a verification can be conducted.</p>
3. Examine the design and required markings for a range of reference standards	<p>3.1.The identification marking required for reference standards is located and explained.</p> <p>3.2.Design features of a range of reference standards are correctly identified and applied.</p> <p>3.3.The function of major components for a range of reference standards is described and applied.</p> <p>3.4.The fundamental features of a range of reference standards are identified and explained.</p>
4. Perform verification of reference standards	<p>4.1.A variety of reference standards are verified.</p> <p>4.2.Uncertainty and tolerances for reference standards are applied.</p> <p>4.3.Results of verification are documented and certificate of verification is issued in accordance with organisational procedures, legislation and policies.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- researching and identifying suitable reference standards for verification within standards hierarchy
- accessing reference manuals to gain appropriate information concerning tolerances for reference standards
- completing the organisation's information tracking documentation
- identifying operational errors relevant to the verification
- locating identification marks on reference standards
- researching design features on a range of reference standards
- completing verification work sheets
- completing and issuing certificates of verification

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- relevant categories of reference standards for which the organisation is authorised to verify
- a range of classes for reference standards
- appropriate tolerance for a range of reference standards
- current status of clients' reference standards
- atmospheric factors required for verifying a range of reference standards
- remedial action for atmospheric deficiencies
- environmental factors that may adversely influence the integrity of the reference standards
- remedial action for a range of environmental deficiencies
- requirements for identification marking on reference standards
- the purpose of design specifications
- the purpose of the major components and functions of reference standards
- the fundamental features of reference standards
- the process for maintaining integrity of results including calculation
- the reference material for uncertainty and maximum permissible errors for a variety of reference standards.
- the process for producing certificates of verification in accordance with verifying authority status

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to verify reference standards. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with verifying reference standards, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Reference standards</b>	Mass, volume, density, area, length, master meters, temperature
<b>Operating procedures</b>	Manufacturers' specifications, industry guidelines, Australian standards, legislation, organisational procedures and guidelines
<b>Legislation and policies</b>	Enabling legislation, organisational procedures and guidelines  Workplace health and safety legislation including storage and transportation of test equipment, handling of test equipment, handling of hazardous materials, safety clothing, manual handling techniques, site/premises conditions
<b>Documentation</b>	Fees, verification work sheets, certificate of verification

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Quality
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## MEM15024A Apply quality procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying established quality procedures to an employee's own work within a manufacturing, engineering or related environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers essential skill and knowledge that underpins all units within the Metal and Engineering Training Package.</p> <p>This competency is applied to an individual's own work. It includes concepts of meeting customer needs to achieve outcomes that are 'fit for purpose'. This includes following quality procedures to conform to specifications and requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight:</b> There is no unit weighting for this unit.</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Take responsibility for own quality	1.1. Concept of supplying product or service to meet the customer requirements (internal and external) is understood and applied. 1.2. Responsibility is taken for quality of own work.
2. Apply standard procedures of workplace quality to own job	2.1. Quality system procedures are followed. 2.2. Conformance to specifications is ensured.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
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## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- identifying and communicating instances of non-compliance to work specifications
- following quality procedures including work instructions
- conforming to product and process specifications
- checking and clarifying task-related information

### Required knowledge

Look for evidence that confirms knowledge of:

- concepts of quality and the benefits of using specifications and standard operating procedures
- quality procedures applying to own work
- standard operating procedures
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply quality procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying quality procedures or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Quality</b>	Consistently meeting customer requirements

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Quality
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## MEM16001B Give formal presentations and take part in meetings

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers participating in formal meetings and giving formal presentations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is intended to cover the communication skills needed when individuals are required to make formal presentations and participate in meetings governed by formal rules or well-established conventions, for example, meetings which have a formal chairperson, where minutes are recorded, and where roles are relatively well defined.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Participate in formal meetings	1.1.A set agenda is understood and followed. 1.2.Meeting conventions are followed. 1.3.Discussion is focused on the objectives of the meeting.
2. Give formal presentations	2.1.Presentation of a technical, job related or trade nature is given. 2.2.Presentations are accurate and structured and all necessary content is included. 2.3.Sources are acknowledged.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in: <ul style="list-style-type: none"><li>• following an agenda</li></ul>

**REQUIRED SKILLS AND KNOWLEDGE**

- following meeting rules/conventions
- focusing discussions on the objectives of the meeting
- giving a prepared technical/job related presentation clearly and concisely
- preparing and using visual aids and/or handout materials
- logically structuring presentations
- addressing relevant material
- using effective communication strategies for meetings and presentations

**Required knowledge**

Look for evidence that confirms knowledge of:

- the topics for discussion during the meeting
- meeting conventions and terminology
- the objective of the meeting
- the topic/subject on which a presentation is to be made
- effective presentation techniques
- the information to be conveyed
- the sources of information used in the presentation

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to give formal presentations and take part in meetings.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must



<b>EVIDENCE GUIDE</b>	
	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with giving formal presentations and taking part in meetings or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Meeting conventions</b>	<ul style="list-style-type: none"> <li>• Order of proceedings</li> <li>• Punctuality</li> <li>• Language expectations</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Relevancy</li> <li>• Procedures for addressing others</li> </ul>
<b>Sources</b>	<ul style="list-style-type: none"> <li>• Colleagues</li> <li>• Data</li> <li>• Technical information sources</li> <li>• Internet or web sources</li> <li>• Supervisors</li> <li>• Experience</li> </ul>

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Communication
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## MEM16002C Conduct formal interviews and negotiations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning and conducting interviews, participating in interviews and taking part in negotiations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to effective communication in more formal on-site or small group situations where ideas are defined and specific outcomes are sought. The topics covered are often formally identified and records may be kept. Interviews could include job recruitment and progression, performance reviews, grievance, etc.</p> <p>This unit does not cover the skills needed for participation in formal group processes such as meetings which are covered by Unit MEM16001B (Give formal presentations and take part in meetings).</p> <p>For interviews associated with training and assessment, refer to the appropriate units.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	
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## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan and conduct interviews	1.1. Interview is planned and initiated to achieve a specified purpose. 1.2. Suitable questions appropriate to the purpose are used. 1.3. Discretion and confidentiality are exercised where appropriate.
2. Participate in interviews	2.1. Appropriate preparation is undertaken. 2.2. Active listening skills are employed. 2.3. Self-presentation is applied appropriate to the purpose. 2.4. Questions are asked where appropriate. 2.5. Follow-up activities are clarified and reported in accordance with standard operating procedure.
3. Take part in negotiations	3.1. Language appropriate to the other party is used.

ELEMENT	PERFORMANCE CRITERIA
	<p>3.2. Own and others' needs/wants are stated and clarified.</p> <p>3.3. The views of fellow employees, including own group or team, are represented to others.</p> <p>3.4. The appropriate communication medium is selected.</p> <p>3.5. Follow-up activities are clarified and reported in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and formatting interviews
- developing open and closed interview questions to gain required information
- building rapport
- maintaining discretion and confidentiality
- preparing for interviews
- using active listening skills
- identifying interview goals
- identifying selection/assessment criteria
- clarifying follow-up activities
- reporting follow-up activities
- using appropriate language to the other party(s)
- clarifying needs/wants of others
- representing the views of fellow team or group members during negotiations
- selecting appropriate communication media during the negotiations

#### Required knowledge

Look for evidence that confirms knowledge of:

- the purpose of the interview
- the assessment criteria for the interview
- the procedures to be followed in planning and conducting the interview
- the detail/information to be obtained from the interview
- questions appropriate to the detail/information to be obtained

**REQUIRED SKILLS AND KNOWLEDGE**

- active listening techniques that can be applied in interview situations
- the effect(s) of the individual's presentation during the interview upon the interview
- the effect(s) of the timing of questions on the interviewee
- the need to follow-up issues raised during the interview and negotiations
- the procedures for reporting the outcomes of follow-up activities
- the parties to be involved in the negotiations
- the reasons for using appropriate language
- the reasons for maintaining confidentiality
- the reasons for clarifying the needs/wants of others
- the needs/wants of the individual
- the views of fellow team or group members
- a range of communication media
- the appropriate communication medium
- safe workplace practices

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to conduct formal interviews and negotiations.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

<b>EVIDENCE GUIDE</b>	
	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with conducting formal interviews and negotiations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Preparation</b>	<ul style="list-style-type: none"> <li>Identifying and inviting co-interviewers</li> <li>Planning interview</li> <li>Preparation of interview room</li> <li>Accessing required documents and materials</li> <li>Introductions and explanations</li> </ul>
<b>Active listening skills</b>	<ul style="list-style-type: none"> <li>Appropriate body language</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"><li>• Acknowledgements</li><li>• Clarification questions</li><li>• Appropriate responses</li></ul>
Communication medium	<ul style="list-style-type: none"><li>• Face-to-face meeting</li><li>• Telephone</li><li>• Email</li><li>• Written</li><li>• Advocacy</li></ul>

### Unit Sector(s)

Unit sector	
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### Co-requisite units

Co-requisite units		

### Competency field

Competency field	Communication
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## MEM16003B Provide advanced customer service

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying a customer's relationship to the enterprise and the customer's requirements, acting on the customer's requirements, and promoting better customer service.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the provision of comprehensive assistance to customers across a range of products and services.</p> <p>Situations covered would be beyond simple sales or enquiries and could include the taking of one-off or special orders requiring detailed descriptions, the handling of complaints referred for more detailed assistance than the initial point of contact, work as a designated liaison officer etc.</p> <p>Customers can be internal or external. Customer liaison can be undertaken through telephone, written, email or face-to-face contact. Typical applications of this unit would be found in warehouses, service and design departments.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify customer relationship to enterprise	<p>1.1. For repeat customers, formal customer identification details are obtained and checked, for example, by order, requisition or account number according to standard operating procedures.</p> <p>1.2. Customer is identified as a new or repeat customer.</p>
2. Identify customer requirements	<p>2.1. Customer requirements are identified from order or other verbal or written communication.</p> <p>2.2. The degree to which customer requirements can be met is clearly communicated including details such as price, delivery date, quantity or quality.</p> <p>2.3. Alternatives are proposed for any inability to completely satisfy customer requirements.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Action customer requirements	<p>3.1. Appropriate action to implement customer requirements is undertaken, for example by filling or entering of order, corrective action to resolve complaints, or repair or service to customer equipment.</p> <p>3.2. Customer requirements not able to be met immediately are recorded, and follow-up checks are undertaken according to standard operating procedures.</p>
4. Promote better customer service	4.1. Methods of improving customer service are identified and reported.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications and other applicable reference documents
- obtaining and checking customer identification details
- establishing rapport with the customer
- dealing with difficult or unsatisfied customers
- checking and clarifying information
- identifying and communicating the degree to which customer requirements can be met
- identifying alternative products and/or services
- taking appropriate action to meet customer requirements
- recording customer requirements including those not able to be immediately met
- following up unmet customer requirements
- reporting/recommending methods of improving customer service
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for identifying customers and defining customer relationships
- service provision procedures for new/repeat customers
- procedures for identifying customer requirements
- the price of the required product or service
- the quantities of the product available
- the quality and characteristics of the product or service
- the delivery date/requirements of the product or service
- the procedures for informing the customer of the degree to which the customer's requirements can be met
- the reasons for informing the customer promptly of the ability/inability to meet the customer's requirements
- alternative products and/or services that may meet the customer's requirements
- the procedures for actioning customer orders
- the procedures for recording and managing customer complaints
- the procedures for initiating repairs and/or service to customer equipment
- the procedures for managing organisational errors in service provision
- principles and practices of effective customer service
- record keeping requirements of customer service interactions and transactions
- the procedures for following up on unmet customer requirements
- the procedures for reporting/recommending improvement to customer service
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to provide advanced customer service.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with providing advanced customer service or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Customer relationship</b>	<ul style="list-style-type: none"> <li>• Internal or external</li> <li>• Repeat or one-off</li> <li>• New or established</li> <li>• Significance in terms of purchase size, length of association, company status, relationship</li> <li>• Previous history</li> <li>• Special service requirements or conditions</li> <li>• Reciprocal arrangements</li> <li>• Supply chain relationship</li> </ul>
<b>Methods of improving customer service</b>	<ul style="list-style-type: none"> <li>• New documentation</li> <li>• New communication</li> <li>• System improvements</li> <li>• Delivery improvements</li> <li>• Product or service improvements</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Communication
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## MEM16004B Perform internal/external customer service

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers providing assistance to internal/external customers across a range of products and services.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the provision of assistance to internal/external customers across a range of products and services. Situations covered would go beyond simple sales and enquiries and could include taking one-off or special orders requiring detailed descriptions or handling of complaints. Customer liaison can be undertaken through telephone, written, email or face-to-face contact. Typical applications of this unit would be found in service and design departments.</p> <p>This unit should not be selected when Unit MEM16003B (Provide advanced customer service) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify customer requirements	<p>1.1. Customer requirements are identified from verbal or written communication.</p> <p>1.2. The degree to which customer requirements can be met is clearly communicated including details such as cost, delivery date, quantity or quality.</p> <p>1.3. Alternatives are proposed for any inability to completely satisfy customer requirements.</p>
2. Action customer requirements	<p>2.1. Appropriate action is taken to implement customer requirements.</p> <p>2.2. Customer requirements not able to be met are recorded and followed up.</p>



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information
- entering routine and familiar information onto proformas and standard workplace forms
- checking and clarifying information
- following verbal instructions
- orally reporting routine information
- communicating and questioning
- proposing alternative products and/or services
- taking action to implement customer requirements
- recording and following up customer requirements not able to be met

#### Required knowledge

Look for evidence that confirms knowledge of:

- the cost of the required product or service
- the quantities of the available product
- the quality of the available product
- the delivery date of the product or service
- the reasons for informing the customer promptly of the ability/inability to meet the customer requirements
- alternative products and/or services that may meet the customer's requirements
- the procedures for actioning customer orders
- the procedures for recording and actioning customer complaints
- the procedure for recording customer requirements which are not met
- the procedures for following up on customer requirements that are not met
- safe workplace practices

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform internal/external customer service. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing internal/external customer service or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Customer requirements

- Product or service
- Quantity
- Quality
- Price range
- Delivery requirements
- Documentation
- Special requirements

## Unit Sector(s)

### Unit sector

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Communication
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## MEM16005A Operate as a team member to conduct manufacturing, engineering or related activities

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating as a member of a team, where operations and outcomes are dependent on the performance of the entire team.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of team activities that are carried out within a section of a manufacturing, engineering or a related work environment.</p> <p>Activities are interdependent in nature, with each team member providing a critical component of the output.</p> <p>Effective interaction and collaboration between team members is required in order to achieve team goals.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify team goals and processes	<p>1.1.Team goals and requirements are identified.</p> <p>1.2.Processes in place to assist in meeting team goals are identified.</p> <p>1.3.Workflow and processes are described.</p> <p>1.4.Roles and responsibilities of team members are identified.</p> <p>1.5.Relationships within team and with other work areas are identified.</p>
2. Communicate and cooperate with team members	<p>2.1.Effective interpersonal skills are used to interact with team members and to contribute to activities and objectives.</p> <p>2.2.Formal and informal forms of communication are used effectively to support team achievement.</p> <p>2.3.Team members are assisted as required to ensure team achieves goals and requirements.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.4.Diversity is respected and valued in team functioning.</p> <p>2.5.Views and opinions of other team members are understood and reflected accurately.</p> <p>2.6.Workplace terminology is used correctly to assist communication.</p>
3. Work as a team member	<p>3.1.Tasks are performed in accordance with organisational and team requirements, specifications and workplace procedures.</p> <p>3.2.Agreed reporting lines are followed using standard operating procedures.</p>
4. Solve problems as a team member	<p>4.1.Potential and real problems faced by team are identified.</p> <p>4.2.Procedures for avoiding and managing problems are identified.</p> <p>4.3.Problems are solved effectively and in a manner which supports team functioning.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- contributing to achievement of team goals
- communicating and cooperating with team members
- coordinating work effort with others
- applying effective interpersonal skills
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- solving problems

#### Required knowledge

Look for evidence that confirms knowledge of:

- effective interpersonal strategies and skills:

## REQUIRED SKILLS AND KNOWLEDGE

- effective listening
- basic speaking skills
- use of terminology and jargon
- giving and receiving feedback
- checking and clarifying task-related information
- interpreting instructions
- basic conflict resolution
- selecting modes and methods of communication
- identifying and resolving communication breakdowns and barriers
- principles of effective communication
- relationships and roles within team and with others
- reporting relationships and procedures
- own responsibilities with respect to products/services to be provided by team
- skills and competencies of the individual and other employees performing interdependent activities
- team goals, objectives and task requirements
- sources of technical expertise/assistance
- appropriate forms of communication
- hazards and control measures associated with team activities, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate in a work-based team environment.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.



<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating in a work-based team environment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Team goals</b>	Production or manufacturing output, deadlines and timelines, resource use, performance, mistake elimination targets, process improvements, maintenance activity, safety levels
<b>Effective interpersonal skills</b>	Basic listening and speaking skills, use of terminology and jargon, giving and receiving feedback, interpreting instructions, verbal and non-verbal modes and methods of communication, communication breakdowns and barriers, basic principles of effective communication
<b>Formal and informal forms of communication</b>	Meetings, documentation, updates, handover, signage, discussion, explanations, demonstration, electronic
<b>Diversity</b>	Ethnicity, age, gender, demographics, disability
<b>Workplace terminology</b>	Terminology - referring to equipment, processes, workplace areas, staff and procedures - specific to the processes and equipment used in the workplace

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Communication
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## MEM16006A Organise and communicate information

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers accessing, organising and communicating information related to processes or tasks.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in manufacturing, engineering or related environments.</p> <p>It may include information related to production, maintenance or associated processes. Information may be drawn from a variety of sources.</p> <p>This unit includes the ability to communicate using common workplace terminology.</p> <p>For access and recording of data requiring system knowledge and judgement, see Unit MEM16008A (Interact with computing technology).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Access information and/or records	1.1.Information requirements of tasks are determined and relevant information is accessed from a range of sources. 1.2.Workplace terminology is correctly recognised.
2. Organise and analyse information	2.1.Information is interpreted and organised in accordance with enterprise and work requirements. 2.2.Information is analysed according to enterprise and work requirements.
3. Communicate organised information using established workplace methods	3.1.Information is communicated using established workplace methods.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accessing relevant information from a range of sources
- recording, where appropriate, the accessed information
- recognising and using workplace terms
- reading, interpreting and following information in workplace documentation
- checking and clarifying information
- organising, categorising and sequencing information

#### Required knowledge

Look for evidence that confirms knowledge of:

- types of information
- available sources of information
- information analysis techniques
- methods of categorising and organising information
- methods of recording and communicating information

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to organise, analyse and communicate information.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with organising, analysing and communicating information or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Range of sources</b>	Job instructions, specifications, standard operating procedures, charts, lists, documents, computer data, drawings, sketches, tables, technical manuals and/or charts and other applicable reference material
<b>Workplace terminology</b>	Terminology - referring to equipment, processes, workplace areas, staff and procedures - specific to the processes and equipment used in the workplace
<b>Analyse</b>	Analysis for this unit involves simple determinations of relevance and implication for the employee's immediate work requirements
<b>Established workplace methods</b>	<ul style="list-style-type: none"> <li>• Proforma reports</li> <li>• Data entry e.g. bar coding and simple keyboard operations</li> <li>• Verbal</li> <li>• Drawings</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



## Competency field

Competency field	Communication
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## MEM16007A Work with others in a manufacturing, engineering or related environment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers operating in an interactive work environment.</p> <p>It covers contribution to a group effort in order to plan and carry out work. This includes identification of work roles, communication and cooperation with others.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work-related group activities that typically occur in and between sections or departments of an enterprise. Employees would normally be working together to achieve a common purpose e.g. manufacture of a product, maintenance of plant and equipment.</p> <p>Individuals are not responsible for the overall group effort but would be required to contribute to activities and objectives using their own existing technical competencies.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify roles and responsibilities	1.1. Own role and responsibilities are identified. 1.2. Relationships within immediate group and with employees performing related/interdependent activities are identified.
2. Plan activities	2.1. Common goals, objectives and task requirements are identified and clarified with appropriate persons. 2.2. Individual tasks are determined and agreed on according to workplace procedures.
3. Work with others	3.1. Effective interpersonal skills are applied to interact with others and to contribute to activities and objectives. 3.2. Assigned or agreed tasks are performed in

ELEMENT	PERFORMANCE CRITERIA
	<p>accordance with agreed requirements, specifications and workplace procedures.</p> <p>3.3. Work progress is reviewed and modified as agreed to complement the work of others.</p> <p>3.4. Agreed reporting lines are followed using standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- contributing to planning and allocation of work
- performing assigned tasks
- coordinating work effort with others
- following agreed reporting lines
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- applying effective interpersonal skills

#### Required knowledge

Look for evidence that confirms knowledge of:

- effective interpersonal strategies and skills:
  - effective listening
  - basic speaking skills
  - use of terminology and jargon
  - giving and receiving feedback
  - checking and clarifying task-related information
  - interpreting instructions
  - basic conflict resolution
  - selecting modes and methods of communication
  - identifying and resolving communication breakdowns and barriers
  - principles of effective communication

## REQUIRED SKILLS AND KNOWLEDGE

- relationships and roles within immediate group and with interdependent others
- reporting relationships and procedures
- own responsibilities with respect to products/services to be provided
- skills and competencies of the individual and other employees performing interdependent activities
- common goals, objectives and task requirements
- sources of technical expertise/assistance
- appropriate forms of communication
- hazards and control measures associated with workplace activities, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate in a work-based team environment.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

<b>EVIDENCE GUIDE</b>	
	with operating in a work-based team environment or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Effective interpersonal skills</b>	Basic listening and speaking skills, use of terminology and jargon, giving and receiving feedback, interpreting instructions, verbal and non-verbal modes and methods of communication, communication breakdowns and barriers, basic principles of effective communication

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Communication
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## MEM16008A Interact with computing technology

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers accessing, inputting and storing information used in manufacturing, engineering or related environments, using computing technology.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies in manufacturing, engineering or related environments. It involves identifying the type and source of information required, and using the technology to access, input and store information. The equipment may include computers and a range of other equipment based on computing technology.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Nature and scope of task requirement are identified. 1.2.Information/data required to be accessed, input or stored is identified. 1.3.Source of information/data is identified.
2. Access information/data	2.1.Access procedures are followed. 2.2.Technology is navigated to find the required information/data. 2.3.Relevant software application menus, functions and commands are used to locate required information/data. 2.4.Information/data is retrieved using organisational procedures. 2.5.Information/data is checked for relevance to job requirements.
3. Input information/data	3.1.Relevant software menus, functions and commands are used to manipulate information/data. 3.2.Information/data is entered, changed, or removed as required.
4. Store	4.1.Data/files are saved following standard procedures

ELEMENT	PERFORMANCE CRITERIA
information/data	<p>prior to exiting the application.</p> <p>4.2.Data output is produced as required.</p> <p>4.3.Procedures for shutting down/logging off/exiting computing technology are followed.</p>
5. Access assistance as required	<p>5.1.Appropriate personnel are identified and consulted as required.</p> <p>5.2.Manuals, online help and other reference materials are identified and used as required.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- ability to enter or retrieve data using appropriate software applications
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- using numerical operations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- functions and capabilities of various types of computing technology used in the workplace
- functions of software applications
- hazards and control measures associated with using computing technology, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to interact with computing technology to achieve workplace outcomes.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with interacting with computing technology or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

#### Guidance information for

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Access procedures**

Logging on and security procedures, virus checks, start-up routines, application start-up

**Technology**

Hand held data recording devices, screen based equipment, personal computers, bar coders

**Applications**

- Word processing spreadsheets and databases
- Customised engineering and manufacturing applications
- Material Resource Planning (MRP)
- Warehousing inventory applications
- Predictive reliability and maintenance applications
- Production data management applications

**Data output**

Report, email, chart, graph, printout, data transfer, labels

**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Communication
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## MEM16009A Research and analyse engineering information

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers researching and analysing information and preparing the information for dissemination.
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### Application of the Unit

<b>Application of the unit</b>	<p>In this unit, the employee may be researching and analysing engineering information for dissemination. Materials and documents mentioned are based on relevant knowledge of the employee competency level.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16006A	Organise and communicate information
	MEM16012A	Interpret technical specifications and manuals

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research information	1.1. Research requirements are identified and clarified with appropriate persons. 1.2. Sources of research data/information are identified and verified for currency and accuracy. 1.3. Information is compiled, recorded and stored using research techniques appropriate to the task requirements. 1.4. Information is sorted for relevance to research and analysis requirements. 1.5. Research is conducted within given timeframe, resource and quality constraints.
2. Analyse information	2.1. Scope, criteria and method for analysis are determined and verified, if necessary, with appropriate persons. 2.2. Information is accurately analysed according to established criteria. 2.3. Analysis is documented in an appropriate format according to workplace requirements.
3. Establish findings and conclusions	3.1. Findings are factual and accurately describe the results of the analysis 3.2. Conclusions are reached that are logical and based on objective analysis of available data.

ELEMENT	PERFORMANCE CRITERIA
	3.3. Research data, analysis, findings and conclusions are verified, if necessary, with appropriate persons.
4. Summarise and organise technical data	<p>4.1. Information is recorded in suitable form according to workplace requirements.</p> <p>4.2. Information is summarised and organised for ease of reference, using established communication principles.</p> <p>4.3. Information is disseminated to others according to workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- questioning
- applying research techniques
- checking and clarifying information
- note-taking
- analysing information and data
- sorting and identifying relevant information/data
- establishing findings and conclusions based on analysis
- summarising and organising information and technical data
- preparing materials for dissemination to others
- planning and sequencing operations

#### Required knowledge

Look for evidence that confirms knowledge of:

- basic principles and methods of research and analysis
- effective communication principles with respect to research, analysis and organisation of technical data
- sources of research data/information



**REQUIRED SKILLS AND KNOWLEDGE**

- use of internal/external databases
- relevant personnel for consultation
- relevant information/data
- effect of variations in the information/data on the conclusions reached
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to research and analyse engineering information. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with researching and analysing engineering information or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Research requirements**

Purpose, expected outcomes, scope and nature, timeframe, required resources

**Sources of research data/information**

- Surveys
- Interview
- Observation
- Test results
- Data records
- Reference books and journals
- Technical manuals
- Job histories
- Internal/external databases

**Research techniques**

- Surveying/scanning
- Skimming

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Questioning</li> <li>• Note-taking</li> <li>• Summarising</li> <li>• Relationship diagrams</li> <li>• Tabling</li> </ul>
<b>Communication principles</b>	<ul style="list-style-type: none"> <li>• Avoidance of ambiguity, redundancy, verbosity, circumlocution etc.</li> <li>• Use of headings</li> <li>• Logical ordering</li> <li>• Summarising</li> <li>• Layout</li> <li>• Customising material to audience</li> <li>• Use of graphics and tables</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Communication
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## MEM16010A Write reports

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing technical or non-technical reports that include some level of analysis and/or research.
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### Application of the Unit

<b>Application of the unit</b>	<p>The term report is used to denote any required written communication that goes beyond a simple recording of facts (such as completion of a pro forma shift production schedule) and which is based on a level of analysis and/or research.</p> <p>Where reports include technical information or details, then the writer would have the required technical knowledge/capability.</p> <p>Conclusions and/or recommendations where required are based on prior research or analysis of data. The analysis and conclusions should be consistent with the level of skill and knowledge of an employee working at that level. Simple analysis and research would be required.</p> <p>If data research and analysis is necessary to produce information for the report, Unit MEM16009A (Research and analyse engineering information should also be selected).</p> <p>For preparation of simple technical reports, see unit MEM16014A (Report technical information).</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM14005A	Plan a complete activity

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify report requirements	1.1.Requirements for a written report are identified and confirmed with appropriate persons. 1.2.Information for the report is accessed according to workplace procedures. 1.3.Information is assessed for currency, accuracy and relevance for inclusion in the report.
2. Prepare and produce report	2.1.A structure and outline of the report are developed according to identified report requirements.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.2.The report is written using terminology appropriate to the reader and established principles of report writing.</p> <p>2.3.Findings and conclusions are based on factual analysis.</p> <p>2.4.Recommendations, alternatives/suggestions are given, and supporting evidence supplied, where required.</p> <p>2.5.Protocols, conventions and legal requirements related to acknowledgements and intellectual property are applied where necessary.</p>
3. Finalise and distribute report	<p>3.1.The report is checked for accuracy and edited as required.</p> <p>3.2.The completed report is consistent with objectives and requirements.</p> <p>3.3.The report is copied, distributed and stored according to instructions and workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- following instructions
- checking and clarifying information
- sorting information/data
- assessing information/data for relevance
- using terminology and language appropriate to the target audience
- structuring and writing reports
- applying principles of report writing
- presenting findings and conclusions based on factual analysis
- making recommendations

**REQUIRED SKILLS AND KNOWLEDGE**

- managing own time
- planning and sequencing information
- reviewing and editing

**Required knowledge**

Look for evidence that confirms knowledge of:

- principles of report writing
- report types and purposes
- structure, style and parts of a report
- use of language and expression in reports
- common pitfalls, such as ambiguity, truisms, tautology, verbosity, circumlocution etc.
- report numbering systems
- techniques for reviewing and editing
- importance and benefits of preparing reports appropriate for the intended audience
- referencing and the importance of acknowledging sources
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to write reports. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must

**EVIDENCE GUIDE**

	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with writing reports or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Requirements</b>	Purpose, expected outcomes, scope and nature, timeframe, required resources
<b>Report</b>	<ul style="list-style-type: none"> <li>Reports types:</li> </ul>



**RANGE STATEMENT**

	<ul style="list-style-type: none"> <li>• accident/injury</li> <li>• equipment report</li> <li>• memo and letter reports</li> <li>• information report</li> <li>• analytical report</li> <li>• Report structure: <ul style="list-style-type: none"> <li>• title page</li> <li>• table of contents</li> <li>• summary</li> <li>• introduction</li> <li>• body (findings and conclusions)</li> <li>• recommendations</li> <li>• references</li> <li>• appendices</li> <li>• glossary</li> </ul> </li> <li>• Report content: <ul style="list-style-type: none"> <li>• text</li> <li>• graphs</li> <li>• charts</li> <li>• tables</li> <li>• diagrams</li> </ul> </li> </ul>
<b>Principles of report writing</b>	<ul style="list-style-type: none"> <li>• Use of headings, subheadings, sectioning and numbering</li> <li>• Objectivity</li> <li>• Expression</li> <li>• Language and grammar</li> <li>• Sentence and paragraph structure</li> <li>• Logical ordering and sequencing</li> <li>• Summarising and editing</li> <li>• Layout and spacing</li> <li>• Content relevancy</li> <li>• Use of graphics, charts, tables, illustrations etc.</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Communication
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## MEM16011A Communicate with individuals and small groups

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers communicating effectively across a range of communication networks in the workplace. Communication levels include interpersonal (one-to-one), person-to-group, and mediated (e.g. telephone, letter, memo).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies where an individual is required to undertake a broad range of communication activities within a manufacturing or engineering organisation.</p> <p>The person would regularly use a variety of communication channels and media to communicate with others.</p> <p>To satisfy this unit, the person would need to exercise skills in verbal and non-verbal communication, along with demonstrating an understanding of communication principles and processes.</p> <p>Applications include common workplace activities such as facilitating small group discussions and meetings, writing memos or letters, making telephone calls, counselling co-workers, resolving issues or routine conflicts, talks or speeches.</p> <p>This unit includes written communication by letter, short memorandum or report etc. If research and/or structured report writing is required, Unit MEM16009A (Write reports) and/or Unit MEM16009A (Research and analyse engineering information) should be selected.</p> <p><b>Band:</b> This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band</p>
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	B unit for progression to C5 (AQF level V).
	<b>Unit Weight: 2</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM16006A	Organise and communicate information

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan and prepare	1.1.Communication types and networks within the

ELEMENT	PERFORMANCE CRITERIA
communication	<p>enterprise are identified.</p> <p>1.2.Enterprise conventions, policies and procedures are followed when planning and preparing communication activities.</p> <p>1.3.Communication channels and codes appropriate to objectives, circumstances and receiver/s are selected.</p> <p>1.4.Communication is planned and structured to promote the accurate transfer of meaning.</p> <p>1.5.Communication setting and climate is established appropriate to purpose and content of message.</p> <p>1.6.Required resources are prepared and or obtained.</p>
2. Communicate effectively in interpersonal, mediated and group settings	<p>2.1.Effective communication skills, strategies and principles are applied to a variety of communication events.</p> <p>2.2.Verbal and non-verbal language is used appropriate to the topic, sensitivities and technical understanding of the person/s being addressed.</p> <p>2.3.Individual differences are respected and considered.</p> <p>2.4.Purpose and objectives of communication are adhered to.</p> <p>2.5.Participation in communication is encouraged.</p> <p>2.6.Conventions, rules, policies and procedures are followed.</p>
3. Evaluate communication	<p>3.1.Feedback regarding the effectiveness of the communication activity is obtained.</p> <p>3.2.Outcomes are assessed against communication objectives and selected channels and codes.</p> <p>3.3.Communication barriers are identified and strategies for overcoming them are identified and implemented.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- selecting and using various communication channels
- coding and decoding verbal and non-verbal messages
- giving and receiving feedback
- identifying blockages, barriers and breakdowns in communication
- applying principles of effective communication
- applying speaking and listening skills to interpersonal and group situations
- using writing skills to communicate technical and non-technical information using common verbal written channels
- undertaking reading and comprehension of written workplace communications

### Required knowledge

Look for evidence that confirms knowledge of:

- communication process, stages and roles
- communication types and networks
- verbal and non-verbal channels - advantages and disadvantages
- verbal and non-verbal codes - advantages and disadvantages
- principles, strategies and conventions for interpersonal, mediated and group communication
- communication skills for sender and receiver
- communication blockages, barriers and breakdowns and strategies for overcoming them
- individual differences between communicators and strategies for effective communication
- establishing communication climate

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to communicate across a range of environments using different methods and techniques appropriate to the content and purpose of the communication. Competency

<b>EVIDENCE GUIDE</b>	
	in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with complex communication or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Communication types</b>	<ul style="list-style-type: none"> <li>• Upward - examples: reporting, suggestions, grievances</li> <li>• Downward - examples: policy, procedure, job instruction, feedback, information</li> <li>• Horizontal - examples: task coordination, conflict resolution, discussion, problem solving, information sharing</li> </ul>
<b>Communication networks</b>	<ul style="list-style-type: none"> <li>• Hierarchies, patterns or clusters of personnel</li> <li>• Enterprise conventions, protocols and procedures for communication</li> </ul>
<b>Communication channels and codes</b>	<ul style="list-style-type: none"> <li>• Channels - defined here as the route a message takes through any of the three broad media: written verbal, spoken verbal and non-verbal</li> <li>• verbal channels involve visual and sound media.</li> <li>• non-verbal channels may involve visual, sound, touch, taste and smell and combinations of these</li> <li>• Codes - defined here as any system of language, symbols, signals, gestures etc. that gives mutual meaning to a message. Codes may be:               <ul style="list-style-type: none"> <li>• verbal (spoken or written language)</li> <li>• non-verbal e.g. symbols and emblems, body language</li> </ul> </li> </ul>
<b>Effective communication skills, strategies and principles</b>	<ul style="list-style-type: none"> <li>• Questioning and clarifying</li> <li>• Speaking and conversation skills</li> <li>• Effective and active listening</li> <li>• Reading and comprehension skills</li> <li>• Giving and receiving feedback</li> <li>• Giving and interpreting verbal and non-verbal messages</li> <li>• Using the telephone and similar mediated channels</li> </ul>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Establishing communication climate</li> <li>• Basic conflict resolution</li> <li>• Seeking and acknowledging contribution</li> <li>• Agreeing on communication protocols</li> <li>• Clarifying the purpose of the communication activity</li> <li>• Principles and protocols for informal and formal meetings</li> <li>• Principles and protocols for speaking to a group</li> <li>• Group discussion strategies, principles and protocols</li> <li>• Interpersonal strategies and principles</li> </ul>
<b>Communication events</b>	<ul style="list-style-type: none"> <li>• Letters, memos, emails etc.</li> <li>• Telephone calls</li> <li>• Group talk</li> <li>• Meetings</li> <li>• Individual and group discussion</li> <li>• Task coordination</li> <li>• Information sharing</li> </ul>
<b>Individual differences</b>	<ul style="list-style-type: none"> <li>• Age, sex, ethnic origin, language</li> <li>• Status in the organisation</li> <li>• Level of expertise</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Communication
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## MEM16012A Interpret technical specifications and manuals

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying, accessing, interpreting and analysing technical information in an enterprise, including quality documentation, equipment manufacturer specifications, engineering data sheets and national standards. It also covers explaining and using the information, and identifying implications of changes to technical information.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit goes beyond routine accessing and interpretation of technical information. This unit applies to the identification, access, interpretation and analysis of technical information to enable carrying out engineering or manufacturing activities.</p> <p>For routine accessing, organising and communication of information related to processes or tasks, MEM16006A Organise and communicate information should be regarded as sufficient.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify and locate technical information resources	1.1.Information needs are identified and confirmed with appropriate persons. 1.2.Workplace information resources are identified and their location is determined in the information system. 1.3.Appropriate technical information is obtained.
2. Access technical information	2.1.Relevant technical information is located using search techniques appropriate to the resource and information requirements. 2.2.Symbols, codes, legends, and abbreviations are interpreted correctly. 2.3.Technical information is accessed and relevant

ELEMENT	PERFORMANCE CRITERIA
	<p>application is understood.</p> <p>2.4. Clarification or further explanation of technical information is obtained, where required.</p> <p>2.5. If applicable, the revision status of the technical information is verified to ensure current status.</p>
3. Interpret and analyse technical information	<p>3.1. Technical information/data appropriate to work requirements and/or application is checked for currency and authenticity.</p> <p>3.2. Technical information is interpreted and analysed for use in given engineering or manufacturing applications.</p> <p>3.3. Technical information is used according to the specific engineering or manufacturing application.</p>
4. Explain and use information	<p>4.1. Information and analyses is explained and distributed to appropriate personnel.</p> <p>4.2. Information resources are used according to work requirements.</p> <p>4.3. Where applicable, work is undertaken in accordance with acquired technical information.</p>
5. Identify implications of changes to technical information	<p>5.1. Technical information systems are monitored for changes.</p> <p>5.2. Personnel affected by changes to internal or external specifications or other technical information are identified.</p> <p>5.3. Means of distributing changed information are established.</p> <p>5.4. Changes to technical information are documented according to enterprise procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accessing, reading and following information on written job instructions,

**REQUIRED SKILLS AND KNOWLEDGE**

- specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning, sequencing operations
  - following oral/written instructions
  - checking and clarifying task-related information
  - checking for conformance to specifications
  - undertaking numerical operations and calculations/formulae within the scope of this unit
  - entering information onto workplace documents
  - accessing and using technical documentation
  - identifying and using correct specifications for process and/or systems
  - using components of system, where appropriate
  - completing formal documentation and reporting as required
  - adopting appropriate communication strategy, including confirmation of received information and distribution of instructions
  - communicating information in ways appropriate for the audience
  - maintaining appropriate records
  - identifying and analysing implications of changes to information systems

**Required knowledge**

Look for evidence that confirms knowledge of:

- available industry information resources
- uses and applications of information resources
- range of formats that information can be presented
- safe work practices and procedures
- location and retrieval requirements of system information
- correct process used to identify relevant specifications
- quality improvement processes for information systems
- interpretation of technical data and information
- appropriate communication strategies
- dissemination of information regarding information systems
- a range of instructional techniques
- implications of changes to technical information
- procedures for responding to information changes
- hazards and control measures associated with changes to technical information, including housekeeping
- safe workplace practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to interpret and analyse information from specifications and manuals.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with interpreting and analysing information from specifications and manuals or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

#### Guidance information for

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Information resources</b>	Documented management system (manufacturing, quality, environmental, occupational health and safety), manufacturers' manuals, specifications, Australian and international standards, customer requirements, industry manuals, codes of practice, legislation etc. in hard and soft copy
<b>Location</b>	Reference libraries, workplace storage areas, internet, site
<b>Information system</b>	Internal and/or external. The system would typically have documentation tiers
<b>Technical information</b>	Technical information and data suitable and appropriate for advanced trade and technician applications within the enterprise. This unit does not cover documentation written for professional engineering or scientist applications
<b>Search techniques</b>	<ul style="list-style-type: none"> <li>• Computer database and internet search/look-up</li> <li>• Standard techniques to identify relevant information including skimming and scanning, identifying key words/ideas, using index, table of contents, numbering and classification systems etc.</li> </ul>
<b>Analyses</b>	Conclusions made from the analysis of technical information



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Communication
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## MEM16013A Operate in a self-directed team

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers an individual effectively participating in a highly developed and self-directed team.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to participation in a formally established, developed or developing self-directed team.</p> <p>Examples are engineering production teams responsible for a product or process, maintenance teams and special-purpose project teams.</p> <p>Typically, team parameters, constraints and objectives would be determined by sources external to the team.</p> <p>The team would be responsible for all aspects of its designated function and members would have day-to-day responsibility for managing themselves and their work.</p> <p>Typical team tasks might include planning and scheduling activities, making production-related decisions and acting on problems.</p> <p>Where team parameters require adjustment as a result of team discussions or planning, then appropriate authorisation and approvals are established using standard operating procedures. Individual team participants would already be competent with technical aspects of team activities.</p> <p>This unit is intended to apply to participation within a formally established and recognised team. Where an individual works with others, such as within a section or department, unit MEM16007A (Work with others in a manufacturing, engineering or related environment) should be regarded as sufficient.</p> <p>This unit may be included in a Certificate II in</p>
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	<p>Engineering - Production Technology or higher qualification.</p> <p><b>Band:</b> This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight:</b> 2</p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM16007A	Work with others in a manufacturing, engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify team function and composition	<p>1.1. Team purpose and scope are identified and understood.</p> <p>1.2. Team composition, including role of self and team members, is understood.</p> <p>1.3. Established parameters, rules and team norms are identified and understood.</p>
2. Participate in team planning	<p>2.1. Significant contribution is made to planning the team activities, based on the individual's technical skills, knowledge and competence.</p> <p>2.2. Contribution is made to the allocation and performance of team tasks.</p>
3. Function effectively as a team member	<p>3.1. Interaction with team members is in accordance with established rules, conventions and procedures.</p> <p>3.2. Tasks and responsibilities are performed effectively and in accordance with team objectives.</p> <p>3.3. Real or perceived issues are resolved by effective and appropriate contributions from team member.</p> <p>3.4. Significant contribution is made to team performance, based on member's own technical skills and application of established principles and practices for effective teamwork.</p>
4. Monitor and review team performance	<p>4.1. The team member participates effectively in the planning and development of team review process.</p> <p>4.2. Relevant performance data is collected and analysed on an individual and team basis using standard enterprise procedures and methodology.</p> <p>4.3. Results are used to evaluate own and team performance against established performance indicators and to assist determination of improvement requirements.</p> <p>4.4. Principles/techniques for effective team development are used to identify own/team improvement strategies.</p>
5. Implement team performance	<p>5.1. Performance improvement processes and strategies are implemented on an individual and collective basis</p>

ELEMENT	PERFORMANCE CRITERIA
improvements	<p>using standard enterprise procedures.</p> <p>5.2. Individual and team performance improvements are evaluated using standard enterprise procedures.</p> <p>5.3. Adjustments to improvement strategies are made in accordance with team requirements and standard enterprise procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying team goals and objectives
- participating in team planning - shared and individual
- allocating tasks and sequencing activities
- communicating and interacting effectively with team members
- solving problems individually and with others
- resolving conflict
- performing various team behavioural functions - task and maintenance focused
- making individual and joint decisions
- coordinating effort with others to achieve common objectives
- collecting team performance data
- reviewing performance against indicators
- identifying strategies to improve team performance
- implementing performance improvement processes
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking and clarifying task-related information
- checking for conformance to specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- team objectives
- team targets/goals, performance indicators

## REQUIRED SKILLS AND KNOWLEDGE

- team member roles - task and behavioural
- team processes, rules and conventions
- scope of work for which the team is responsible
- methods for planning team activities
- team member technical skills, knowledge and competence, relevant to the tasks being planned
- the person(s) responsible for team planning
- impact of planning decisions on other teams, personnel and/or resources
- procedures for obtaining resources
- structure, formation and operation of teams
- characteristics of effective teams
- strategies for effective team development/functioning
- effective team communication
- forms of team leadership and decision-making
- strategies for resolving conflict
- techniques for team problem-solving
- issues that may affect team performance
- the sources of data relevant team performance indicators
- reasons for reviewing team performance
- methods/procedures to evaluate team performance
- where appropriate, source(s) of approval to change team performance parameters
- processes/strategies for improving team performance
- hazards and control measures associated with operating in a self-directed team environment, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate within a self-directed team. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating within a self-directed team or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Team**

- A highly developed and cohesive work group in which the individuals have a common aim, and in which the jobs and skills of each member fit in with those of others
- Team members manage day-to-day activities within operating parameters and constraints
- The team is typically characterised by interdependent and complementary effort, high cohesion and culture, conjunctive tasks, effective use of team resources and a focus on continuous improvement
- The team may have a single leader or shared leadership

**Principles and practices for effective teamwork**

Relating to:

- goals
- problem solving
- resolving conflict
- team leadership
- team decision making
- team rules and norms
- team roles and behaviours
- team maintenance

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Communication
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## MEM16014A Report technical information

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing reports of a technical nature on tasks or assignments within the employee's skill and competence.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applied to the reporting of technical and engineering information beyond simple communication of facts (such as completion of a pro forma shift production schedule). The technical information being reported is based on analysis and/or research appropriate for the information being conveyed.</p> <p>The unit assumes that the person reporting the technical information has the technical skills to either have undertaken the analysis and reporting themselves or to be able to critically discuss and answer questions on the information that is being reported.</p> <p>If detailed data research and analysis is necessary to produce information for the report, Unit MEM16009A (Research and analyse engineering information) should also be selected.</p> <p>Where detailed/complex written reports are required, Unit MEM16010A (Write reports) should be considered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16006A	Organise and communicate information

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify information required for report	1.1.Reporting requirements are identified according to standard operating procedures and confirmed where necessary with appropriate persons. 1.2.Methods for investigating and justifying information to be presented are determined
2. Prepare report	2.1.Information required for the report is accessed according to workplace procedures.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.2.Information is assessed for currency, accuracy and relevance for inclusion in report.</p> <p>2.3.The content, structure and format of information is appropriate for the information and type of report</p> <p>2.4.Findings and conclusions are based on factual analysis.</p> <p>2.5.Recommendations and alternatives are given if required and supporting evidence is supplied.</p> <p>2.6.The report is copied, distributed and stored according to instructions and workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- following instructions
- checking and clarifying information
- accessing and sorting information/data
- assessing information/data for relevance
- using terminology and language appropriate to the target audience
- structuring and formatting technical information
- presenting findings and conclusions based on factual analysis
- making recommendations
- managing own time
- planning and sequencing information
- reviewing and editing

#### Required knowledge

Look for evidence that confirms knowledge of:

- reporting methods and purposes
- structure, style and parts of a short report

**REQUIRED SKILLS AND KNOWLEDGE**

- correct use of language and expression
- techniques for checking and editing
- importance and benefits of preparing reports appropriate for the intended audience
- referencing and the importance of acknowledging sources
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to report technical information to others at a level above the simple retelling of factual information. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with reporting technical information or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Report**

- Reports for this unit are written documents conveying technical information that at a minimum contain a description of the issue being addressed, some discussion and conclusions which may include recommendations. The report may be formal or informal. Examples of the type of reports that could be covered by this unit are:
  - accident/injury report
  - equipment purchase report
  - condition monitoring report
  - test results
  - production data
- Reports may be in number of formats

<b>RANGE STATEMENT</b>	
	<p>including:</p> <ul style="list-style-type: none"> <li>• a standard workplace format</li> <li>• memoranda</li> <li>• written short reports</li> <li>• For the purposes of this unit a report must include: <ul style="list-style-type: none"> <li>• reference to the scope of the report</li> <li>• justification for any conclusions</li> <li>• references to any authorities or persons responsible for investigations and or conclusions</li> <li>• description of the methodology involved in preparing and analysing the technical information in the report</li> </ul> </li> <li>• While the above information must be included this unit does not require report preparation skills to the level required to prepare fully referenced and corroborated academic reports.</li> <li>• Where detailed/complex written reports of this nature are required, Unit MEM16010A (Write reports) should be considered.</li> </ul>
<b>Reporting requirements</b>	Purpose, expected outcomes, scope and nature, timeframe, required resources

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Communication
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## MEM17001B Assist in development and deliver training in the workplace

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning for and delivering on the job training, and reviewing the training program. Training, which may be structured or informal, is delivered in a one-to-one or small group situation.
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### Application of the Unit

<b>Application of the unit</b>	<p>Training is delivered in a one-to-one or small group situation. The training may be structured or informal and based on cooperation between trainer and other training personnel. Both underpinning knowledge and practical skills are covered by the training. Training may be applied to technical, induction, OHS or other areas.</p> <p>Normal supervision of an apprentice is covered by Unit MEM17003A (Assist in the provision of on the job training). This unit does not cover assessment. Assessor skills are covered in Unit MEM17002B (Conduct workplace assessment).</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan for delivery of on the job training	1.1.Objectives of training and competency to be achieved are identified. 1.2.Role in provision of training is clarified.
2. Deliver on the job training	2.1.Training objectives are explained to trainee. 2.2.Training is carried out using appropriate techniques: logical presentation; sound communication methods; explanation, demonstration; practice; feedback. 2.3.Trainee progress is monitored and constructive

ELEMENT	PERFORMANCE CRITERIA
	feedback is provided to trainee.
3. Review training program	3.1. Training program is evaluated according to standard operating procedures. 3.2. Training data is recorded according to standard operating procedures. 3.3. Training is reported according to standard operating procedures. 3.4. Training is promoted according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating effectively with the trainee
- applying training techniques appropriate to the trainee and training requirements
- giving feedback
- monitoring and recording trainee progress
- evaluating training program
- recording training data
- completing reports on training completed and training required
- promoting training within the workplace

#### Required knowledge

Look for evidence that confirms knowledge of:

- competencies to be achieved through the training
- role of the trainer in the provision of training
- training techniques to be used in delivering the training
- reasons for selecting the chosen training techniques
- procedures for recording trainee progress
- reasons for providing positive feedback
- procedures for evaluating training programs
- reasons for evaluating training programs

**REQUIRED SKILLS AND KNOWLEDGE**

- training records to be kept
- procedures for recording training data
- procedures for preparing training reports
- procedures for promoting training in the workplace
- reasons for promoting training in the workplace

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assist in development and delivery of training in the workplace.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in the development and delivery of training in the workplace or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be

**EVIDENCE GUIDE**

	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Objectives of training</b>	Achieve effective and safe operation of equipment, induction to organisational practices and procedures, continuous improvement, provision of technical information
<b>On the job training</b>	Logical presentation; sound communication methods; explanation, demonstration; practice; feedback

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Training
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## MEM17002B Conduct workplace assessment

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying, planning and carrying out assessment; recording the results; and reviewing the procedure. Methods of assessment may include observation, documentation, demonstration, projects, oral tests, computer based assessment, written tests, etc.
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### Application of the Unit

<b>Application of the unit</b>	<p>Appropriate assessment techniques will be selected based on assessor knowledge of the competency to be assessed or in conjunction with someone who is competent (technical expert). Assessment may be undertaken on an individual basis or in groups. This unit is intended to equate to national competency standards Assessment Standard Unit: Conduct assessment to an established procedure, and the Extension Unit: Plan and review assessment. This competency also meets the assessment skills required to be recognised by Manufacturing Skills Australia as a workplace assessor.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify and plan assessment requirements	<p>1.1. Area and purpose of assessment are identified in consultation with appropriate personnel and person/s being assessed.</p> <p>1.2. Appropriate competency standard/s and assessment guides are identified and selected as required.</p> <p>1.3. Evidence required to establish competency is determined according to industry and enterprise assessment procedure.</p> <p>1.4. Evidence required and assessment arrangements are discussed and confirmed in an appropriate way with person being assessed.</p>
2. Carry out assessment	2.1. Agreed assessment procedure is implemented in a



ELEMENT	PERFORMANCE CRITERIA
	<p>manner, time and location to maximise active participation from assessment candidate/s.</p> <p>2.2.Evidence consistent with the agreed assessment procedure is gathered using appropriate and specified methods and tools, and is documented according to agreed industry or site procedures.</p> <p>2.3.Evaluation and assessment decisions are made according to agreed assessment procedures.</p> <p>2.4.Clear and appropriate feedback is provided to person/s assessed.</p> <p>2.5.Advice is provided to assessment candidate/s on training needs, appeal mechanisms, as appropriate.</p>
3. Record results and review the procedure	<p>3.1.Assessment results are recorded according to industry or site procedures.</p> <p>3.2.Records are kept/stored in a manner appropriate to maintenance of confidentiality and safety.</p> <p>3.3.Assessment procedure are reviewed in cooperation with person being assessed and revised, if appropriate.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant competency standards and assessment guides
- discussing and confirming evidence required and the assessment arrangements
- performing assessments
- gathering and documenting evidence
- evaluating evidence and making assessment decisions
- providing clear and appropriate feedback
- advising on training needs and/or the appeals procedures
- recording assessment results
- storing records
- reviewing and revising the assessment procedure

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- area and purpose of the assessment
- persons to be consulted when determining the assessments to be carried out
- relevant competencies
- evidence required to establish competency
- reasons for identifying the evidence to be obtained
- industry assessment procedure
- reasons for discussing and confirming the assessment arrangements with the assessment candidate
- time and location of the assessment
- reasons for selecting the time/location for the assessment
- methods of gathering the evidence
- reasons for using the selected methods of obtaining evidence
- procedures for documenting the assessment
- procedures for evaluating the gathered evidence
- need to provide clear and positive feedback to the assessment candidate
- appeals procedure
- any further training required by the assessment candidate
- procedures for recording assessment results
- need to keep records securely stored
- procedures for storing assessment records
- procedures for reviewing assessments undertaken
- reasons for evaluating assessment methods/procedures
- procedures for revising assessment procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to conduct workplace assessment.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with conducting workplace assessment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Purpose of assessment</b>	Recognition of prior learning, determination of award classification level or identification of training needed
<b>Evidence required</b>	Should address task skills, task management, contingency management application
<b>Assessment procedure</b>	Observation, documentation, demonstration, projects, oral tests, computer based assessment, written tests
<b>Appropriate and specified methods and tools</b>	Should address issues such as clarity, reliability, validity of results, fairness in assessment application, and cost effectiveness of process

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

## Competency field

Competency field	Training
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## MEM17003A Assist in the provision of on the job training

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assisting in the provision of on the job training to others while undertaking normal duties.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit may involve the replacement of normal duties with training duties for limited periods of time. The individual would not be expected to be solely responsible for the assessment or reporting of a trainee's progress.</p> <p>Typical applications could include the provision of on the job guidance by a tradesperson to apprentices/trainees or by a production worker to other production workers/trainees.</p> <p>Where development of training programs is involved see Unit MEM17001B (Assist in development and deliver training in the workplace).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine role of on the job training	1.1.Objectives of training and role of on the job training are identified in consultation with team leaders or other appropriate personnel.
2. Provide on the job training	2.1.Training is conducted using learning methods appropriate to the training objectives and learner. 2.2.Trainee progress is monitored and feedback is provided appropriate to the learning outcomes.
3. Report on trainee performance	3.1.Trainee's progress is reported according to standard operating procedure.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant information with respect to the training to be provided
- applying suitable training methods
- providing feedback to the trainee throughout the training process
- reporting on the trainee's progress
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- training to be delivered
- personnel to be consulted with respect to the training to be provided
- the individual's role in the provision of training
- objectives of the training
- the person(s) to be trained
- procedures to be followed when training individuals
- training location(s)
- tools, equipment, procedures, materials and resources
- training delivery methods, their applications, advantages and disadvantages
- feedback techniques
- reasons for monitoring trainee progress
- reporting procedures
- hazards and control measures associated with assisting in the provision of on the job training, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE



<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to assist in the provision of on the job training.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in the provision of on the job training or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Learning methods</b>	Explanation, demonstration, simulation
<b>Report</b>	Should include information about the skills satisfactorily achieved and those where further practice is required

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Training
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## MEM18001C Use hand tools

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using a range of hand tools for a variety of general engineering applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>Applications may include hand tools used for adjusting, dismantling, assembling and finishing of items or components, and the finishing, cutting, scraping of metallic and non-metallic material to size and shape. This includes simple tapping and threading and routine maintenance of hand tools.</p> <p>This unit should not be selected if the hand tool is dedicated to a single operation or machine and if only a machine specific/customised tool is used.</p> <p>When using hand held power tools or power tools used for hand held operations, refer to Unit MEM18002B (Use power tools/hand held operations).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Use hand tools	<p>1.1.Hand tools are selected appropriate to the task requirements.</p> <p>1.2.Hand tools are used to produce desired outcomes to job specifications which may include finish, tension, size or shape.</p> <p>1.3.All safety requirements are adhered to before, during and after use.</p> <p>1.4.Unsafe or faulty tools are identified and marked for repair according to designated procedures before, during and after use.</p> <p>1.5.Routine maintenance of tools, including hand sharpening is undertaken according to standard</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>operational procedures, principles and techniques.</p> <p>1.6. Hand tools are stored safely in appropriate location according to standard operational procedures and manufacturers' recommendations.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following information on standard operating procedures
- following verbal instructions
- selecting hand tools appropriate to the task
- using hand tools safely
- identifying hand tool defects and marking for repair
- maintaining/sharpening hand tools using appropriate techniques
- storing hand tools in accordance with manufacturers'/standard operating procedures

#### Required knowledge

Look for evidence that confirms knowledge of:

- applications of different hand tools in a general engineering context
- common faults and/or defects in hand tools
- procedures for marking unsafe or faulty tools for repair
- routine maintenance requirements for a range of hand tools
- storage location and procedures for a range of hand tools
- hazards and control measures associated with using hand tools
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use hand tools for a range of general engineering applications.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using hand tools or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Hand tools</b>	Hacksaws, hammers, punches, screwdrivers, sockets, wrenches, scrapers, chisels, gouges, wood planes and files of all cross-sectional shapes and types
<b>Job specifications</b>	Finish, tension, size or shape etc.
<b>Routine maintenance</b>	Cleaning, lubricating, tightening, simple tool repairs, hand sharpening and adjustments using engineering principles, tools, equipment and procedures

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18002B Use power tools/hand held operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using a range of hand held power tools and fixed power tools for hand held operations for a variety of general engineering applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to loosening and fastening items or components and shaping, finishing, cutting, grinding metallic and non-metallic materials and/or tool bits to size and shape.</p> <p>This unit should not be selected if the power tools used are dedicated to an operation or machine, e.g. nut-runner, air drill, power driver, etc.</p> <p>For using hand tools, see Unit MEM18001C (Use hand tools).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use power tools	<p>1.1.Power tools are selected appropriate to the task requirements.</p> <p>1.2.Power tools are used for a determined sequence of operations - which may include clamping, alignment and adjustment to produce desired outcomes - to job specifications which may include finish, size or shape.</p> <p>1.3.All safety requirements are adhered to before, during and after use.</p> <p>1.4.Unsafe or faulty tools are identified and marked for repair before, during and after use according to designated procedures.</p> <p>1.5.Operational maintenance of tools, including hand sharpening, is undertaken according to standard</p>

ELEMENT	PERFORMANCE CRITERIA
	workplace procedures, principles and techniques. 1.6. Power tools are stored safely in appropriate location according to standard workshop procedures and manufacturers' recommendations.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following information on standard operating procedures
- following verbal instructions
- selecting power tools appropriate to the task
- using power tools safely
- using clamping/securing devices
- identifying power tool defects
- maintaining power tools using appropriate techniques
- sharpening tools/tool bits within the scope of this unit
- storing power tools according to manufacturers'/ standard operating procedures.

#### Required knowledge

Look for evidence that confirms knowledge of:

- application of different power tools
- clamping/securing methods
- adjustments/alignments to a range of power tools
- common faults and/or defects in power tools
- procedures for marking unsafe or faulty power tools for repair
- routine maintenance requirements of a range of power tools
- tool sharpening techniques for a range of power tools
- storage location and procedures of a range of power tools
- hazards/control measures associated with power tools
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to use power tools/hand held operations.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using power tools/hand held operations or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Power tools**

Electric or pneumatic/hydraulic drills, grinders, jigsaws, nibblers, cutting saws, sanders, planers, routers, pedestal drills and pedestal grinders

**Clamping**

Multigrips, vices, jigs and fixtures, clamps etc.

**Job specifications**

Finish, size or shape etc.

**Operational maintenance**

Hand sharpening, cleaning, lubricating, tightening  
Simple tool repairs and adjustments using engineering principles, tools, equipment and procedures to statutory and regulatory requirements

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18003C Use tools for precision work

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using tools to manually produce work to precise dimensions and or finishes.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work is undertaken autonomously or in a team environment, using predetermined standards of quality, safety and workshop procedures.</p> <p>This unit involves using a variety of tools, instruments and power equipment to perform precision tasks on a range of metallic and non-metallic materials.</p> <p>As a guide, the types of precision work covered by this unit could include:</p> <ul style="list-style-type: none"><li>• scraping machine beds to precise tolerances</li><li>• broaching a tapered keyway</li><li>• hand reaming the bore of a spigot or bush to a positive transition fit with shaft</li><li>• core drilling (finishing) a blind locating hole to receive a mating pin</li><li>• lapping a mechanical seal to fine finish</li><li>• filing complex angles and mating edges</li><li>• precision grinding using flex-drive attachment or similar</li></ul> <p>Inspection and preventative maintenance of tools and equipment involves the visual checking of leads and connections, sharpening of cutting equipment and the repair of associated tools.</p> <p>Where precision measurement is required, Unit MEM12003B (Perform precision mechanical measurement) should also be selected.</p> <p>Where precision marking out is required, Unit</p>
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	<p>MEM12006C (Mark off/out [general engineering]) should also be selected.</p> <p>Where specifications are interpreted from engineering drawings, detailed/technical sketches and associated documents, Unit MEM09002B (Interpret technical drawing) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Task requirements and specifications are determined and clarified with appropriate persons.</p> <p>1.2.Processes/techniques are selected appropriate to task, specifications and material.</p>
2. Prepare tools and tooling to produce precision outcome	<p>2.1.Tools, accessories and consumables are selected appropriate to task, specifications and material.</p> <p>2.2.Where applicable, cutting tool modifications required to produce outcome are determined using engineering principles.</p> <p>2.3.Tools/tooling are prepared and modified as required.</p>
3. Use tools to produce work to precise specifications	<p>3.1.The work area is prepared and made safe.</p> <p>3.2.The work piece is prepared and secured using appropriate method for selected operation/s.</p> <p>3.3.Tools are used according to acceptable engineering principles, methods, applications and procedures to produce specified outcome to the required accuracy.</p> <p>3.4.Tools and equipment are inspected for safe and proper working order before, during and after use.</p> <p>3.5.Unserviceable tools/equipment are identified, repaired where appropriate, or marked for repair and/or disposal, according to prescribed procedure.</p> <p>3.6.Tools are stored and maintained to ensure serviceability.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- obtaining and interpreting relevant drawings, specifications, instructions etc.
- preparing and making safe the work area(s) prior to the work being carried out
- using appropriate tools to produce the specified outcomes
- checking tools and equipment for safe and proper working order before, during and after use
- where appropriate, marking unsafe or faulty tools and equipment for repair
- where appropriate, repairing/maintaining unsafe or faulty tools
- checking condition of all tools and equipment for conformance to specifications and safe and proper operation prior to storage
- safely storing all tools and equipment in the appropriate location

**Required knowledge**

Look for evidence that confirms knowledge of:

- work to be undertaken
- specifications to be achieved
- appropriate tools, processes and equipment required to carry out the work to the required specifications
- reasons for selecting the chosen tools, processes and equipment
- hazards and control measures associated with using the selected tools, processes and equipment, including housekeeping
- safety procedures to be followed to ensure the safety of the individual and other personnel
- procedures for using the selected tools
- engineering principles to be applied during the use of the tools
- manufacturers' specifications of the tools and equipment selected
- safe and proper function of tools and equipment selected
- procedures for checking tools and equipment for correct and safe operation
- common faults and/or defects in tools and equipment used/selected
- procedures for marking unsafe or faulty tools and equipment for repair
- repairs/operational maintenance that can be made to the tools and equipment used/selected
- procedures for repairing/maintaining the tools and equipment used/selected
- procedures for checking tools and equipment prior to storage
- storage location of the tools and equipment used/selected
- procedures for storing tools and equipment used/selected

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to use tools to fashion or shape work to high levels of precision for dimension and or finish to specifications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using tools for precision work or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Processes**

- Hand tools and hand held power tools are used to fashion or shape work to high levels of precision for dimension and or finish to specifications
- Engineering techniques, methods and procedures may include cutting out, drilling, fitting, filing, reaming, lapping, broaching, burnishing, scraping, polishing, hand held grinding, chiselling

**Precision outcomes**

Specified tolerances, allowances, fits, finishes, alignments

**Tools**

Any tools or equipment required to achieve precision outcomes

**Tool modifications**

Tool shape, rake angle and clearance angles

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18004B Maintain and overhaul mechanical equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers diagnosing, locating faults, repairing, overhauling, fitting and adjusting mechanical systems and equipment.</p> <p>This unit integrates the application of prerequisite diagnostic, maintenance and overhaul competencies.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to situations where an integrated level of skills in maintenance and overhaul of mechanical systems and equipment is required.</p> <p>This unit builds on skills covered by the prerequisites.</p> <p>Where additional specialist skills are required, appropriate units should also be selected.</p> <p>Where extensive system knowledge for safe shut-down/isolation of machinery/equipment is required, Unit MEM18011C (Shut down and isolate machines/equipment) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18005B	Perform fault diagnosis, installation and removal of bearings
	MEM18006C	Repair and fit engineering components
	MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies
	MEM18009B	Perform levelling and alignment of machines and engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the
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	required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform preventative maintenance tasks and adjustments	<p>1.1.Preventative maintenance schedule is read and task requirements are determined.</p> <p>1.2.Appropriate maintenance principles and techniques are used and routine maintenance tasks are performed on mechanical equipment, components or sub-assemblies using correct tools, equipment and procedures.</p> <p>1.3.Mechanical equipment, components, sub-assemblies are checked visually and with test equipment, using prescribed procedures and safety requirements to ensure correct function or determine malfunction.</p> <p>1.4.Adjustments are made to equipment or components to ensure specifications are met using acceptable fitting techniques and procedures, observing all safety requirements.</p>
2. Diagnose and locate faults	<p>2.1.Equipment component function is determined by reference to engineering drawings, technical manuals and or consultation with appropriate personnel.</p> <p>2.2.Maintenance reports are checked, reviewed and faults are diagnosed.</p> <p>2.3.Consultation with operators and other relevant plant personnel is carried out to assist in locating faults.</p> <p>2.4.Where appropriate, test equipment is selected and applied in accordance with defined requirements and procedures to assist fault location.</p> <p>2.5.Fault condition is diagnosed and localised at component level using appropriate test equipment and procedures.</p> <p>2.6.Faulty condition is evaluated and appropriate corrective action is taken.</p> <p>2.7.Faults are documented to standard operating procedures.</p>
3. Repair or overhaul mechanical system	<p>3.1.Machine or equipment is isolated safely or checked for isolation.</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>3.2. Faulty equipment, component or sub-assembly is removed from system using appropriate engineering principles, tools, equipment and procedures.</p> <p>3.3. Replaceable items are selected from manufacturers' catalogues and obtained by appropriate means.</p> <p>3.4. Correct repair procedure, tools and equipment are selected and prepared for use on serviceable items.</p> <p>3.5. Using appropriate engineering principles, designated procedures, correct tools/equipment and safe workshop practices, serviceable items are repaired or overhauled to manufacturers' or site specifications.</p> <p>3.6. Components are checked with precision instruments to ensure conformance to specifications where applicable.</p>
4. Fit and adjust mechanical equipment	<p>4.1. All electrical, safety and site requirements are adhered to throughout the maintenance cycle.</p> <p>4.2. Maintenance report is completed to standard operating procedures and conveyed to designated personnel.</p> <p>4.3. Fitting requirements are determined and sequential assembly planning is carried out where applicable.</p> <p>4.4. Sound fitting principles and techniques are applied in the preparation and assembly of component parts using fastening equipment and methods which ensure conformance to specifications, operational performance, quality and safety.</p> <p>4.5. Using acceptable maintenance practices, correct gland packing, jointing and gasket materials are selected and applied correctly in conformance to specifications and operational requirements.</p> <p>4.6. Correct lubrication requirements are determined by appropriate means and attended to where applicable using mechanical or manual applications.</p> <p>4.7. Appropriate wedges and levelling devices are used to level mechanical equipment as appropriate.</p> <p>4.8. Correct alignment and balancing functions are performed where appropriate.</p> <p>4.9. Final adjustments are performed on mechanical equipment to align to operational specifications using acceptable engineering principles, fitting techniques and procedures</p> <p>4.10. Mechanical equipment is tested for accuracy and correct operation where applicable, and returned</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>to service to specifications using acceptable procedures.</p> <p>4.11. Appropriate work and safety clearances are obtained throughout maintenance cycle.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing of multiple tasks
- sourcing resources
- using diagnostic skills to check and test mechanical systems/equipment
- using communication skills to consult with operators and other relevant plant personnel to assist in locating faults
- making systematic operational adjustments
- checking system
- using language and literacy skills to enable all reporting requirements to be met including checking maintenance reports; documenting faults etc.
- reading and interpreting engineering drawings, technical manuals equipment component function

#### Required knowledge

Look for evidence that confirms knowledge of:

- preventative maintenance procedures
- functions of system/equipment and their operational requirements
- causes and symptoms of faults and failures
- system and equipment hazard identification and isolation procedures
- options for sourcing replacement parts
- consequences of incorrect adjustments
- procedures for testing the mechanical systems and equipment
- procedures for returning mechanical systems and equipment to service
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with maintaining and overhauling

**REQUIRED SKILLS AND KNOWLEDGE**

mechanical equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to, in an integrated manner, diagnose, locate faults, repair, overhaul, fit and adjust mechanical systems and equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and overhauling mechanical equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Routine maintenance tasks</b>	Checks for correct operation, lubrication, adjustments; repair to leaking glands
<b>Test equipment</b>	Engineers level, laser alignments etc., and appropriate equipment for measurement of alignment, flatness, squareness, straightness, temperature, vibration, load deflection, noise level, RPM
<b>Fitting techniques and procedures</b>	Appropriate fitting principles and techniques are utilised in the assembly/disassembly of component parts using fastening equipment and methods, e.g. dowelling, pinning and pegging, keying, thread production and repair, etc. which ensures conformance to specifications, operational performance, quality and safety. It also includes the straightforward removal and replacement of pre-manufactured bearings and seals and using acceptable maintenance procedures, appropriate lubrication, gland packing, jointing/gaskets, and

**RANGE STATEMENT**

	seals. Materials are selected and applied in conformance to application requirements and specifications as applicable. Using acceptable workshop practices new components are manufactured including by marking out, drilling, scraping, filing, reaming, tapping or threading to specifications
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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# MEM18005B Perform fault diagnosis, installation and removal of bearings

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing routine bearing checks during operations and non-operation, diagnosing bearing faults, identifying bearing requirements for replacement or installation, and removing and installing bearings.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit involves using acceptable engineering principles, correct tools and equipment to undertake routine static and dynamic bearing checks; bearing fault diagnostics; and bearing removal, replacement, installation and lubrication.</p> <p>All bearing replacements are selected from spare parts lists, manufacturers' catalogues, engineering drawings and data sheets.</p> <p>Mounting/dismounting methods may include the use of press, dowel, keys, keeper plate, heat, shrink, hydraulic and mechanical mounting and dismounting tools and associated methods etc.</p> <p>Industry and enterprise standards of quality and safety are used to install and replace plain, ball and roller bearings.</p> <p>Where diagnostic skills are not required and where straightforward removal and replacement of pre-manufactured bearings is undertaken, Unit MEM18055B (Dismantle, replace and assemble engineering components) should be regarded as sufficient.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM12023A	Perform engineering measurements

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform routine bearing checks during operation and non-operation	<p>1.1. Bearing installation is inspected and task requirements are determined by the most appropriate means.</p> <p>1.2. Bearing installation is checked during operation using standard procedures of listening, feeling, observing and by using test equipment appropriate to the installation.</p> <p>1.3. Seal condition is checked for seal and wear leaks using correct and appropriate means.</p> <p>1.4. Lubricating devices are checked for correct operation using tools and techniques appropriate to the task.</p>
2. Diagnose bearing faults	<p>2.1. Visual and sensory inspection of bearing arrangement is performed.</p> <p>2.2. Bearings are tested for correct operation and malfunction using manufacturers' specifications and diagnostic equipment appropriate to the task.</p> <p>2.3. Faulty bearings are identified for replacement using relevant engineering principles.</p> <p>2.4. Causes of failure are identified using techniques and equipment appropriate to the task.</p> <p>2.5. Corrective action to avoid recurrences is taken where necessary.</p>
3. Identify bearing requirements for replacement or installation	<p>3.1. Bearing installation is inspected and task requirements are determined.</p> <p>3.2. Operational function of bearings to be installed or replaced is determined using bearing and engineering principles.</p>
4. Remove bearings	<p>4.1. Bearing removal techniques and tools are determined for the task.</p> <p>4.2. Bearings are removed from shafts or bearing housings with minimal damage to components.</p> <p>4.3. Condition of serviceable items is inspected using measuring and test equipment appropriate to the task.</p> <p>4.4. Serviceable items are repaired using engineering, techniques, tools and equipment appropriate to the task.</p>



ELEMENT	PERFORMANCE CRITERIA
5. Install plain bearings	<p>5.1. Standard replaceable items for plain, wrapped, flanged, split bush and thrust bearings are selected from manufacturers' parts lists, catalogues or engineering drawings.</p> <p>5.2. Installation techniques and tools are selected appropriate to the task.</p> <p>5.3. Bearings are sized to correct clearance.</p> <p>5.4. Lubrication requirements are catered for to meet specification and/or application requirements.</p> <p>5.5. Bearings are fitted correctly.</p> <p>5.6. Bearings are tensioned down and run according to standard operating procedures or manufacturers' recommendations.</p> <p>5.7. Final clearance, adjustments and lubrication are checked and corrective action taken if necessary.</p>
6. Install anti-friction bearings	<p>6.1. Standard replaceable ball and roller anti-friction bearings are selected from manufacturers' catalogues, spare parts lists or interpreted from engineering drawing to meet specifications.</p> <p>6.2. Bearing inside/outside diameters are determined from specifications or manufacturers' catalogue and checked using measuring instruments appropriate to the task.</p> <p>6.3. Shafts and housings size are checked for correct fit and clearances.</p> <p>6.4. Installation techniques are selected appropriate to the task.</p> <p>6.5. Bearings are fitted to shafts or housings using engineering principles and tools, equipment, techniques appropriate to the task.</p> <p>6.6. Bearing are sealed and, where required, capped, to specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

**REQUIRED SKILLS AND KNOWLEDGE****Required skills**

Look for evidence that confirms skills in:

- reading, interpreting and following information on standard operating procedures, manufacturer specifications, and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- measuring bearings and components to specified tolerances
- numerical operations and calculations/formulae within the scope of this unit
- performing routine bearing checks including of seals, lubrication and lubrication devices
- diagnosing bearing faults
- identifying bearing requirements for replacement or installation
- removing bearings
- installing bearings
- checking for conformance to specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- procedures for checking bearings and seals
- procedures for checking bearing lubrication/lubrication devices
- manufacturer specifications
- engineering principles relating to fault diagnosis, installation and removal of bearings
- reasons for deciding to replace/not replace given bearings
- common causes of bearing failure and their indicators
- procedures for determining the appropriate clearances for a range of plain bearings
- procedures for 'sizing' plain bearings
- lubricants and lubrication requirements within the scope of this unit
- hazards and control measures associated with fault diagnosis, installation and removal of bearings
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

**EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform fault diagnosis, installation and removal of bearings. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication materials handling, recording and reporting associated with fault diagnosis, installation and removal of bearings or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for**

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Plain bearings**

Rotational plain bearings:

- plain bush, wrapped bush, flanged bush, split bush, self-lubricating and thrust bearings for radial, thrust and combination radial and thrust loading applications.

**Anti-friction bearings**

Ball and roller bearings (anti-friction or rolling element bearings):

- self-aligning ball bearings with cylindrical bore, taper bore (and adaptor sleeve), taper bore (and unthreaded adaptor sleeve); single row deep groove ball bearings; magneto bearings (separable ball bearings); single row angular contact ball bearings; double row angular contact ball bearings; spherical roller bearings, including narrow type and C design; spherical roller bearings (NV, N NS Type); double row cylindrical roller bearings; linear ball bearings; needle roller bearings; taper roller bearings; single thrust ball bearings; double thrust ball bearings; single thrust ball bearings with spherical housing washer and seating ring; spherical roller thrust bearings; radial bearings with cylindrical, tapered bore (and adaptor or withdrawal sleeve); and associated bearings for radial, axial and combination radial and axial applications

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18006C Repair and fit engineering components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit of competency covers mechanical repair and fitting trade skills including fault finding, repair of faulty components, manufacturing of new parts/components, and fitting mechanical engineering components into assemblies or sub-assemblies to specified measurements and tolerances and consistency with manufacturer's specification.</p> <p>Repair and fitting of engineering components is undertaken using mechanical engineering and maintenance principles, designated procedures, correct and appropriate tools/equipment, and safe working practices.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to repair and fitting work undertaken by a tradesperson in a mechanical maintenance, service or workshop environment. Work is undertaken autonomously or as part of a team using predetermined standards of quality, safety and workshop procedures. Skills covered include determining the need for repair or replacement of parts and assemblies, and undertaking of repair, replacement, assembly and final fitting of items, sub-assemblies and assemblies. All specifications are interpreted from engineering drawings, detailed/technical sketches and associated data sheets. The unit includes the use of appropriate workshop practices. New components are manufactured as required to specifications.</p> <p>This unit has been developed for Engineering Tradesperson - Mechanical apprenticeship training and the recognition of trade level skills in repair and fitting of engineering components. Skills covered by this unit are generally applied in occupational and work situations</p>
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	<p>associated with trade level fitting and machining work. It may also apply to other mechanical trade occupational areas requiring high level repair and fit of engineering component skills.</p> <p>This unit has application in the MEM30205 Certificate III in Engineering - Mechanical qualification and other qualifications requiring a trade level of repair and fit skills.</p> <p>This unit does not address machining competencies and welding, if these are required, the appropriate units should also be accessed. Where additional or higher marking out skills are required, refer to MEM12006C Mark off/out (general engineering). The knowledge and skills associated with the installation, removal, repair or replacement of mechanical seals is covered by MEM18012B Perform installation and removal of mechanical seals. For high pressure fluid power seals, refer to MEM18020B Maintain hydraulic system components.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work

<b>Prerequisite units</b>		
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify scope of repair and/or fit required	<ul style="list-style-type: none"><li>1.1.Operational specifications for components are obtained from appropriate source and are interpreted and understood</li><li>1.2.Operation and condition of components are assessed against specifications</li><li>1.3.Faulty/worn components are identified</li><li>1.4.Causes of faults are determined using appropriate engineering principles, techniques, procedures, tools and equipment</li><li>1.5.Repair, replacement, adjustment or manufacture requirements are determined</li></ul>
2. Repair/replace faulty components	<ul style="list-style-type: none"><li>2.1.Where applicable, appropriate method of repair is determined</li><li>2.2.Where applicable, faulty components are repaired or</li></ul>



ELEMENT	PERFORMANCE CRITERIA
	<p>adjusted to conform to specifications</p> <p>2.3. Where applicable, replacement parts are selected from manufacturers' catalogues and assessed against specifications</p>
3. Manufacture parts/components	<p>3.1. Parts/component specifications are determined from appropriate source</p> <p>3.2. Materials are selected to meet specification requirements</p> <p>3.3. New components are produced in conformance to specifications using appropriate workshop practices</p> <p>3.4. Completed components are inspected for compliance with dimensions</p> <p>3.5. Where appropriate, component parts are marked for identification prior to assembly</p>
4. Fit engineering components into assemblies or sub-assemblies	<p>4.1. Fitting requirements and sequence of assembly are determined</p> <p>4.2. Appropriate fitting principles and techniques are applied in the preparation and assembly of component parts using fastening equipment and methods which ensures conformance to specifications, operational performance, quality and safety</p> <p>4.3. Using acceptable engineering practices, correct gland packing, jointing/gasket materials are selected and applied correctly in conformance to specifications and operational requirements</p> <p>4.4. Correct lubrication requirements are determined by appropriate means and attended to where applicable</p> <p>4.5. Final adjustments are performed on component assembly to meet operational specifications using acceptable engineering principles, fitting techniques and procedures</p>
5. Check operation of repaired components/unit	<p>5.1. Components/unit are checked under operational conditions for compliance to operational specifications using acceptable engineering principles to standard operating procedures</p> <p>5.2. Out of specification modification/alterations are approved by appropriate authority and are recorded and documented to standard operating procedures</p> <p>5.3. Final component assembly is commissioned and returned to service according to standard operating procedures</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- obtaining operational specifications for the components
- assessing operation against specification and identifying faults
- checking components visually and dimensionally against the operational specifications using work site procedures
- checking repaired components visually and dimensionally for conformance to specifications
- adjusting components to achieve conformance to specifications where appropriate
- selecting replacement parts which conform to specifications
- preparing and assembling components using appropriate fitting techniques and principles
- where appropriate, applying gland packing, jointing or gasket materials, using acceptable engineering practices
- applying appropriate lubricants to the assembly using acceptable engineering practices, where required
- checking components for conformance to specification
- where required, adjusting components to achieve conformance to specifications
- where required, recording any approved modifications/alterations to work site procedures
- inspecting the final assembly and checking conformance to operational specifications
- where appropriate, returning the final assembly to service in accordance with work site procedures
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Required knowledge includes:

- tools and equipment to be used to dismantle the components
- consequences of having components that do not comply with operational

## REQUIRED SKILLS AND KNOWLEDGE

- specifications
- types of adjustment applicable to the components being repaired/fitted
- appropriate methods of repair
- features and/or dimensions upon which replacement parts are to be selected
- process of identifying replacement parts from third party suppliers' catalogues
- material properties required
- manufacturing operations to be used in the production of new components
- sequence of operations to be used in the production of new components
- fitting requirements for assembling components
- appropriate sequence of assembly tasks
- purpose of using gland packing, jointing or gasket materials
- reasons for selecting particular jointing or packing materials
- applications of different types of lubricants
- consequences of using inappropriate or no lubricant
- the need to have approval for out of specification modifications
- reasons for documenting out of specification modifications
- return to service procedures
- consequences of not following work site return to service procedures
- hazard and control measures associated with repairing and fitting engineering components, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to repair and fit engineering components to specifications in both workshop and site environments. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently apply the skills covered in this unit of competency in new and different situations and contexts. Critical aspects of assessment and evidence

**EVIDENCE GUIDE**

	<p>include:</p> <ul style="list-style-type: none"> <li>• obtaining manufacturer's and enterprise specifications for equipment, materials and components</li> <li>• checking components visually and dimensionally in the workplace including tolerances, allowances, clearances and limits</li> <li>• repairing and fitting components and assemblies in a workshop environment to required specifications</li> <li>• repairing and fitting components and assemblies in a production or other work site environment</li> <li>• manufacturing and fitting components including commissioning and return to service checking of component and equipment through first off production or other recognised return to service checking procedure</li> <li>• procedures for out of specification modification/alterations.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit has been developed to support training in and recognition of trade level competency repair and fit of engineering components as applied to a trade level fitting and machining work environment. Assessment should emphasise a workplace context and procedures found in the candidate's workplace.</p> <p>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in Engineering Tradesperson - Mechanical work are required to apply their repair and fit skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct</p>

<b>EVIDENCE GUIDE</b>	
	<p>observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials</p>
<b>Guidance information for assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with repair and fit of engineering components or other units requiring the exercise of the skills and knowledge covered by this unit.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Manufacturers' catalogues</b>	Manufacturers' catalogues may include any appropriate manufacturers' catalogues that contain replacement parts that conform with specifications and operational requirements
<b>Appropriate workshop practices</b>	<p>Appropriate workshop practices may include:</p> <ul style="list-style-type: none"> <li>• drilling</li> <li>• scraping</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• filing</li> <li>• reaming</li> <li>• tapping</li> <li>• threading</li> </ul>
<b>Fitting principles and techniques</b>	<p>Fitting principles and techniques may include:</p> <ul style="list-style-type: none"> <li>• limits of tolerance</li> <li>• allowances and clearances</li> <li>• effects of wear, stress, temperature</li> <li>• types of fits - clearance transition interference</li> <li>• press fitting methods</li> <li>• force fits</li> <li>• shrink and freeze (expansion) fits</li> <li>• keyed fits</li> <li>• taper fits</li> <li>• lateral and radial forces</li> <li>• backlash</li> <li>• configuration and mating of parts</li> <li>• applied use of precision tools and measuring equipment</li> <li>• engineering components - shafts, single and multi-throw crankshafts, cams and journals, bearings and bearing surfaces, keys</li> <li>• squareness, roundness, concentricity, flatness, straightness, surface finish and angular correctness</li> <li>• datum and centrelines</li> <li>• tapping, reaming and broaching</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18007B Maintain and repair mechanical drives and mechanical transmission assemblies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers diagnosing faults and repairing drives and transmission assemblies, and undertaking final adjustment and commissioning.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to diagnostics and maintenance, repair, adjustment and commissioning of mechanical drives and mechanical transmission assemblies.</p> <p>This unit should not be selected where either Unit MEM18042C (Diagnose and rectify manual transmissions), or Unit MEM18043C (Diagnose and rectify automatic transmissions) or Unit MEM18044C (Diagnose and rectify drive line and final drives) are also selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18009B	Perform levelling and alignment of machines and engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake maintenance checks of mechanical drives and mechanical transmission components	<p>1.1.Principles of mechanical drives and mechanical transmission components are understood.</p> <p>1.2.The function of the main parts of the designated mechanical drive/transmission assembly is understood.</p> <p>1.3.Appropriate maintenance principles, techniques, tools and equipment, mechanical drive/transmission components are used to check for wear, distortion, tensions, misalignment, fatigue, lubrication, slackness, tooth wear, breakages and other related malfunctions.</p> <p>1.4.Assembly requiring further diagnosis, repair or adjustment is identified and findings are documented.</p>
2. Adjust mechanical drives and transmission assemblies	<p>2.1.Adjustment requirements are determined.</p> <p>2.2.A suitable adjustment method is determined from manufacturers' instruction sheets, standard workshop manuals/procedures or other means.</p> <p>2.3.Adjustment tools and equipment are selected according to the type of assembly being serviced.</p> <p>2.4.Appropriate maintenance principles, techniques, tools and equipment are used, and drives/transmission components are tensioned, aligned balanced or adjusted to manufacturers'/site specifications according to safe workshop practices.</p> <p>2.5 Drive/transmission assembly is checked after adjustment for correct operation or identified for further diagnosis or repair.</p> <p>2.6.Service report is completed.</p> <p>2.7.Further diagnosis or repair requirements are actioned.</p>
3. Diagnose faults	<p>3.1.Service reports are read and visual and sensory inspection of the drive/transmission assembly is undertaken.</p> <p>3.2.Given manufacturers' specifications, and where applicable, diagnostic equipment drive/transmission assembly is tested using sound maintenance principles and procedures.</p> <p>3.3.Faults are localised at the component level and identified for repair or replacement.</p> <p>3.4.Fault causes are analysed and preventative measures</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>to avoid re-occurrence are developed, documented and actioned by appropriate means.</p> <p>3.5.Requirements for repair or replacement are actioned.</p>
<p>4. Repair mechanical drives/transmission assemblies</p>	<p>4.1.Service reports are read and visual and sensory inspection of the drive/transmission assembly is undertaken.</p> <p>4.2.Task requirements are ascertained.</p> <p>4.3.Tools and equipment are selected according to the type of assembly being serviced.</p> <p>4.4.Mechanical drive/transmission assembly is dismantled using appropriate maintenance principles, techniques, tools, equipment and safe workshop practices.</p> <p>4.5.Serviceable items are repaired using appropriate maintenance procedures according to manufacturers' specifications and standard workshop practices.</p> <p>4.6.Standard replaceable items are selected and obtained using manufacturers' catalogues, spare parts lists, engineering specifications.</p> <p>4.7.Component parts are refitted to mechanical drive/transmission assembly using sound maintenance principles, techniques, tools and equipment in accordance with manufacturers'/site specifications.</p>
<p>5. Final adjustment and commissioning</p>	<p>5.1.Using applicable maintenance principles and procedures, drive/transmission components are tensioned, balanced, aligned or adjusted to suit specifications and operational requirements.</p> <p>5.2.Drive/transmission assembly is checked after adjustment and operational performance is analysed.</p> <p>5.3.Assembly is commissioned to specifications.</p> <p>5.4.Service report is completed.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- locating, reading and interpreting information on written job instructions, specifications, manufacturers' instructions, standard workshop manuals/procedures, drawings, charts, lists and other reference documentation
- checking and clarifying task-related information
- interpreting manufacturers' catalogues or engineering specifications
- undertaking diagnostic and testing
- analysing operational performance
- planning and sequencing operations
- completing proformas, standard workplace forms and short reports using relevant terminology
- checking for conformance to specifications
- measuring components to specified tolerances
- undertaking calculations for determining cutting parameters and checking tolerances
- undertaking numerical operations and engineering calculations/formulae within the scope of this unit
- following verbal instructions
- orally reporting information

### Required knowledge

Look for evidence that confirms knowledge of:

- uses and characteristics of lubricants
- principles of operation of a range of mechanical drives and transmissions
- techniques, tools and equipment to measure components
- common malfunctions in mechanical drives, transmissions and their components
- procedures for checking and adjusting mechanical drives, transmissions and their components
- preventative measures that can be undertaken to avoid recurrence of the fault/failure
- any applicable industry standards, national/Australian standards, NOHSC guidelines, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with maintaining and repairing mechanical drives and mechanical transmission assemblies

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to diagnose faults and repair drives and transmission assemblies and undertake final adjustment and commissioning. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining/repairing mechanical drives and mechanical transmission assemblies or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

**EVIDENCE GUIDE**

	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Mechanical drive/transmission</b>	Worm and worm wheel, line shafts, plumber blocks, pulleys, sprockets, belts, taper bush assemblies, roller chains, chain drives, mechanical and hydraulic couplings, compression couplings, disc type flexible couplings, spider type, chain couplings, universal joints, bevel gearing, rack and pinion gearing, dog toothed clutches, cone type clutches, expanding shoe type clutches, friction/plate type clutches, centrifugal clutches, toggle action linkages, magnetic clutches, sprag clutches, band type brakes and other associated drive components.
<b>Service reports</b>	According to workplace procedures
<b>Sensory inspection</b>	Vibration, heat, smell, sound, sight
<b>Commissioned</b>	Confirming readiness for use or return to service

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18008B Balance equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking the balance and balancing equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work is undertaken with minimum supervision or team environment. Work may be undertaken in the field, on-site or in a workshop environment. Balancing may include the addition or removal of material. All specifications for machine operation and degree of balance to be supplied.</p> <p>Wheel and tyre balancing is covered in Unit MEM18038B (Maintain wheels and tyres).</p> <p>Where additional fitting and repair skills are required then MEM18003C (Use tools for precision work) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check balance	1.1.Principles of equipment balance testing are understood.

ELEMENT	PERFORMANCE CRITERIA
	<p>1.2. Most appropriate balancing check procedure is selected.</p> <p>1.3. Component is set up correctly and to site/manufacture's procedure for balance check.</p> <p>1.4. Balance/out of balance is determined and compared to specification requirements.</p> <p>1.5. Out of balance readings are recorded to prescribed procedures.</p>
2. Balance equipment	<p>2.1. Principles and methods of rigid and/or flexible rotation balancing are understood.</p> <p>2.2. Techniques of single and/or multi-plane balancing are used appropriate to application.</p> <p>2.3. Equipment is balanced utilising correct procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting up component to be balanced
- operating balancing equipment
- recording out of balance readings
- balancing equipment using the appropriate techniques
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- checking for conformance to specifications
- undertake numerical operations, geometry and calculations/formulae within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- principles of balancing

## REQUIRED SKILLS AND KNOWLEDGE

- reasons for testing equipment for balance
- effect of out of balance components on machine/equipment operation and life
- several procedures for checking the balance of equipment
- the most appropriate procedure to be applied to selected balancing situations
- reasons for selecting the chosen balancing check procedure
- procedures for setting up the component to be balanced
- procedures for operating the balancing equipment
- specifications of the component to be balanced
- procedures for recording out of balance readings
- principles of rigid and flexible rotation balancing
- methods of rigid and flexible rotation balancing
- the techniques of single and multiple plane balancing
- the appropriate balancing technique for given balancing situations
- reasons for selecting the chosen balancing technique
- procedures for balancing out of balance equipment
- the precautions to be taken when adding or removing material to achieve balance
- hazard and control measures associated with balancing equipment, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to balance equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with balancing equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Equipment**

Equipment may range from static balancing

**RANGE STATEMENT**

	devices to sophisticated electronic dynamic balancing machines
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18009B Perform levelling and alignment of machines and engineering components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking levelling and alignment measurements/readings and performing levelling and/or alignment tasks.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the setting up and use of alignment measuring devices and precision levelling devices. All adjustments are performed according to designated procedures in conformance to specifications.</p> <p>The application of appropriate engineering principles, techniques, tools and equipment is integral to all tasks relating to the levelling of equipment and the alignment of component parts.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake levelling and alignment measurements/readings	<p>1.1.Principles of levelling and alignment are understood and utilised.</p> <p>1.2.Task requirements are determined by inspection of equipment to be levelled and/or components to be</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>aligned.</p> <p>1.3.The correct appropriate levelling and/or alignment procedure is selected.</p> <p>1.4.Correct and appropriate levelling or alignment devices/equipment are selected and set up to standard operating procedures or manufacturers' recommendation.</p> <p>1.5.Measurements/readings are taken accurately and recorded correctly to standard operating procedures.</p>
2. Perform levelling and/or alignment tasks	<p>2.1.Correct and appropriate engineering principles, techniques, tools and equipment are selected.</p> <p>2.2.Levelling realignment calculations are performed using correct and appropriate method for levelling/alignment application.</p> <p>2.3.Equipment is levelled to specifications using correct and appropriate techniques</p> <p>2.4.Levelling and alignment task is completed to specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on standard operating procedures, manufacturer recommendations, drawings and other applicable reference documents
- taking levelling and alignment measurements/readings
- performing levelling/alignment calculations
- setting up levelling/aligning equipment
- completing levelling and/or alignment tasks

#### Required knowledge

Look for evidence that confirms knowledge of:



## REQUIRED SKILLS AND KNOWLEDGE

- principles of levelling and alignment
- numerical operations, geometry and calculations/formulae for levelling and alignment
- effects on equipment performance and life of non-level or out of alignment components
- techniques, tools, equipment and procedures to carry out the levelling and/or alignment
- reasons for selecting tools, techniques and equipment
- hazards and control measures associated with levelling and alignment
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to level and align machines and engineering components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with levelling and aligning machines and engineering components or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Levelling and/or alignment procedures</b>	Face and rim, reverse indicator, use of jacking bolts and shimming material, straight edge and feeler gauge, use of levelling equipment, etc.
<b>Levelling and alignment devices/equipment</b>	Precision levels, spirit levels, line levels, optical levels, electronic levels, laser levels, dial indicators, special type dial indicator fixtures, magnetic bases, feeler gauges, bench centres, vee blocks, plumb line, folding wedges, straight

RANGE STATEMENT	
	edges, shimpack materials, dumpy levels etc.
<b>Level or realignment calculation</b>	Performed using the most appropriate means for the type of application being performed
<b>Specifications</b>	Obtained from engineering drawings, data sheets or manufacturers' specifications

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18010C Perform equipment condition monitoring and recording

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

Unit descriptor	This unit covers undertaking condition monitoring.
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### Application of the Unit

Application of the unit	<p>This unit applies where specialist monitoring activities are undertaken as part of a preventive maintenance or total productive maintenance plan or program. Work is undertaken autonomously or as part of a team environment. Monitoring is undertaken in workshop, laboratory or in situ environment; readings are undertaken to the accuracy of monitoring equipment limitations or to site specifications where applicable. Results are recorded/plotted to predetermined procedure and technique. All work and work procedures are undertaken to standard operating procedures and/or equipment manufacturers' recommendations. All work and work practices are undertaken to regulatory or legislative requirements.</p> <p>Where only routine maintenance checking and diagnostic skills are applied, other appropriate units should be accessed.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake condition	1.1.Principles and methods of equipment condition

ELEMENT	PERFORMANCE CRITERIA
monitoring	<p>monitoring are understood and applied</p> <p>1.2.Appropriate condition monitoring technique is selected to achieve required outcomes.</p> <p>1.3.Checks are undertaken correctly, safely and to standard operating procedures.</p> <p>1.4.Results are plotted and deviations from specification are reported to appropriate authority and recorded.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- applying correct principles for monitoring
- selecting appropriate technique for the situation
- following standard operating procedures
- recording results and preparing and submitting deviation reports

#### Required knowledge

Look for evidence that confirms knowledge of:

- the application of principles and methods for a variety of situations
- appropriate records for a variety of situations
- hazards and control measures associated with equipment monitoring, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform equipment condition monitoring and recording. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with equipment condition monitoring and recording or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Technique may include**

Built-in systems (software and site displays), vibration monitors, infra-red and ultraviolet non-destructive testing

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		



## Competency field

Competency field	Maintenance and diagnostics
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## MEM18011C Shut down and isolate machines/equipment

### Modification History

Single band identifier removed to clarify dual status.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers isolating and shutting down machines and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to situations that require extensive system knowledge that exclude the straightforward starting/stopping of machinery/equipment through the use of simple switching, including use of emergency switches. Shut-down/isolation is undertaken autonomously or as part of teamwork.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Shut down machine/equipment	1.1.Machine/equipment operational function is determined and understood. 1.2.Shut-down sequence is undertaken safely and to standard operating procedures. 1.3.Machine/equipment is depressurised/emptied/de-energised/bled to standard operating procedures. 1.4.Safe shut-down of machine/equipment is verified. 1.5.Safety/security lock-off devices and signage are installed to standard operating procedures. 1.6.Machine/equipment is left in clean and safe state.
2. Isolate machine/equipment	2.1.Machine/equipment operational function is determined and understood. 2.2.Isolation methods and points are recognised and identified.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.3.Isolation is undertaken safely and to standard operating procedures.</p> <p>2.4.Safe isolation of machine/equipment is verified.</p> <p>2.5.Safety/security lock-off devices and signage are installed to standard operating procedure.</p> <p>2.6.Machine/equipment is left in clean and safe state.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications and other applicable reference documents
- checking and clarifying task-related information
- entering information onto proformas and standard workplace forms
- shutting down machine/equipment
- purging/de-energising equipment
- installing safety/security lock-off devices and signage\

#### Required knowledge

Look for evidence that confirms knowledge of:

- the operational function of the machine/equipment
- the shut-down sequence
- the procedures for shutting down and isolating the machine/equipment
- safety precautions for shutting down and isolating the machine/equipment
- procedures for purging/de-energising the machine/equipment and reasons for doing so
- procedures for verifying machine/equipment shut-down and isolation and reasons for verifying
- the safety/security lock-off devices and signage to be installed
- the reasons and procedures for installing lock-off devices and signage
- the reasons for ensuring the machine/equipment is left in a clean, safe state
- hazards and control measures
- use and application of personal protective equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to shut down and isolate machines/equipment.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with shutting down and isolating machines/equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate

<b>EVIDENCE GUIDE</b>	
	must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Shut down/isolate</b>	Shut down/isolation means and includes isolation of mechanical, electrical drives, pipework (pressure) rotating equipment etc. utilising electrical lock-off isolators, mechanical and power driven valves etc. in accordance with standard operating instructions. Relevant regulations, Australian standards and legislative requirements governing isolation and shut-down must be complied with
<b>Machine/equipment</b>	Manual, semi automatic and automatic machines of a stand-alone, continuous production or process nature.

## Unit Sector(s)

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18012B Perform installation and removal of mechanical seals

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers dismantling, selecting, reassembling and installing mechanical seals.
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### Application of the Unit

<b>Application of the unit</b>	<p>Tasks involve the checking, installation, removal and replacement of a range of mechanical seals.</p> <p>Skills covered by this unit include the knowledge of appropriate applications for a range of mechanical seals and the ability to remove, select, repair or replace all component parts of the seal.</p> <p>Lubrication requirements are attended to according to suppliers' instructions and recommendations or specifications.</p> <p>All removal and installation practices are to be undertaken in conformance to safe workplace practices and procedures, using correct tools and equipment.</p> <p>For straightforward replacement of seals, Unit MEM18055B (Dismantle, replace and assemble engineering components) should be regarded as sufficient.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Determine mechanical seal requirements	1.1.Principles of mechanical seals are understood and applied. 1.2.Operational function of mechanical seal components is understood. 1.3.For new mechanical seal installation, specifications are interpreted from engineering drawings etc.
2. Dismantle mechanical seal installations	2.1.Mechanical seal assembly is examined and appropriate dismantling techniques, tools and equipment are selected to suit work requirements. 2.2.Mechanical seal assembly is dismantled using engineering techniques and safe workshop procedures appropriate to the work requirements. 2.3.All component parts are examined for wear, including housing, shafts, primary sealing elements, secondary seals, seat assembly etc., to determine need for repair or replacement. 2.4.Where applicable, serviceable items are repaired by appropriate means. 2.5.Primary sealing elements and secondary seals are removed for replacement where required, using correct and appropriate engineering techniques and tools.
3. Select replacement items	3.1.Replacement items are selected using manufacturers' catalogues, spare parts lists, engineering specifications or sample, using standard operating procedures.
4. Reassemble mechanical seal installations	4.1.Mechanical seal components are fitted using correct and appropriate engineering techniques and tools, including seal head, secondary seals, seat assembly, shaft and housing. 4.2.Mechanical seal assembly is tensioned and adjusted to manufacturers' specifications. 4.3.Mechanical seal assembly is tested using appropriate methods for compliance with specifications and operational performance.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- reading, interpreting and following information on standard operating procedures, written job instructions, specifications, charts, lists, drawings and other applicable reference documents
- determining mechanical seal requirements
- dismantling mechanical seal installations
- selecting replaceable items
- reassembling/repairing mechanical seal installations
- adjusting mechanical seal tensions
- testing mechanical seal assembly
- checking for conformance to specifications
- measuring components to specified tolerances

**Required knowledge**

Look for evidence that confirms knowledge of:

- principles of operation and range of mechanical seals
- components and function of a range of mechanical seal designs
- installation specifications and procedures
- failure patterns/wear limits of mechanical seal components
- techniques/tools for removing primary sealing elements and secondary seals from the mechanical seals
- units of measurement, numerical operations and calculations/formulae within the scope of this unit
- reasons for selection of the mechanical seal
- specified mechanical seal tension
- testing mechanical seals
- techniques, tools and equipment to measure components
- hazards and control measures associated with installing/ removal of mechanical seals, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to dismantle, select, reassemble and install mechanical seals. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with dismantling, selecting, reassembling and installing of mechanical seals, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Seals**

Range of mechanical seals may include carbon, satellite, neoprene and other associated materials

**Mechanical seal assembly**

Range of mechanical seal assemblies used across different sealing applications

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units**

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18013B Perform gland packing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers inspecting glands and gland packing, and removing and replacing or topping up gland packing.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to, but is not limited to, packing for high or low temperatures and pressures, solids, gases, liquids.</p> <p>Skills that relate to maintaining simple gland top-ups in non-critical applications and routine gland maintenance are covered by Unit MEM18006C (Repair and fit engineering components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools
	MEM12023A	Perform engineering measurements

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect glands and gland packing	1.1.Principles of gland packing are applied. 1.2.Stuffing box assembly and gland packing are inspected and job requirements are determined.
2. Remove gland packing	2.1.Using appropriate engineering techniques, tools and equipment, gland is extracted or removed.
3. Replace or top up gland packing	3.1. Correct and appropriate gland packing is selected and cut to size and shape to conform with application and/or specifications. 3.2.The stuffing box is filled with packing material and the gland is reassembled using standard operating procedures or manufacturers' recommended procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE



## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- checking and clarifying task-related information
- inspecting glands and gland packing
- removing gland packing
- cutting gland packing to size and shape
- replacing or topping up gland packing
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- following oral instructions
- entering routine and familiar information onto proformas and standard workplace forms

### Required knowledge

Look for evidence that confirms knowledge of:

- principles of gland packing
- tools, techniques and equipment required to remove gland packing
- various types of gland packing
- reasons for selecting gland packing
- methods of cutting gland packing to size and shape
- reassembling procedures
- hazards and control measures associated with gland packing, including housekeeping
- safe work practices

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to pack glands. Competency in this unit cannot

<b>EVIDENCE GUIDE</b>	
	be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gland packing or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Packing material**

Carbon, hemp, rubber, leather, teflon, felt, neoprene etc. that are flat, ribbon, square, round, moulded, dry and lubricated, etc.

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

**Competency field****Competency field**

Maintenance and diagnostics

## MEM18014B Manufacture press tools and gauges

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing to manufacture and manufacture tooling (press tools and gauges) including matching use of hand and hand held power tools, assembly of the tooling components and trialling the tooling.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit includes the skills required to manufacture and trial all types of production tooling. Work is undertaken autonomously or in a team environment.</p> <p>The tooling being produced may include, but is not limited to, the following types: press tools, jigs, fixtures, gauges, special purpose machines and equipment requiring precision manufacture. A normal range of tool room equipment would be used which may include lathes, mills, copy/duplicator, grinders, EDM and wire cut equipment, precision measurement, hand and power tools.</p> <p>Where simple welding or brazing skills are required, see Units MEM05012C (Perform routine manual metal arc welding) and Unit MEM05006B (Perform brazing and/or silver soldering). Where manufacture of cavity dies is required, unit MEM18097A (Manufacture cavity dies) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing
	MEM07005C	Perform general machining
	MEM07006C	Perform lathe operations
	MEM07007C	Perform milling operations
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18015B	Maintain tools and dies
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM30012A	Use mathematical techniques and perform simple statistical

<b>Prerequisite units</b>		
		computations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare to manufacture tool or gauge	<p>1.1.Tooling requirements are determined from customer's components drawings, prints or sample component.</p> <p>1.2.Tooling type and design are conceptualised and planned with reference to customer's specifications (written or verbal) for numbers, finish, quality and material.</p> <p>1.3.Production machine to be used to produce components is assessed and considered in tooling design.</p> <p>1.4.Tool design is interpreted and visualised from tooling drawings, prints or plan and checked against customer requirements.</p> <p>1.5.Selected production machine mounting requirements are determined to ensure any special or additional provisions are incorporated in tooling design.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Manufacture tooling	<p>2.1.Appropriate materials are selected and obtained to meet tooling requirements for strength, durability, component finish, heat treatment qualities where necessary and accounting for materials availability.</p> <p>2.2.Selected material is tested for hardness as appropriate to aid selection of machine tools, hand tools and hand held power tools to be used to fashion or shape tooling components.</p> <p>2.3.Plan is developed to sequence and stage manufacturing process, including establishing datum, mark out, rough out (machine or fashion), stress relieve/heat treat, finish size, fashion and fit and assemble componentry.</p>
3. Perform machining operations	<p>3.1.Appropriate machines and machining process is selected from a range of standard tool room machines to shape/produce tooling components to specifications.</p>
4. Use hand and hand held power tools	<p>4.1.A range of hand and hand held power tools are selected and used to fashion/manufacture tooling components to specification.</p> <p>4.2.Where practical, components sample or section is produced for testing.</p>
5. Assemble tooling components	<p>5.1.Using acceptable tool making techniques and procedures, components are checked and fitted/assembled correctly to specifications.</p>
6. Trial tooling	<p>6.1.First-off component is checked with precision instruments against specification.</p> <p>6.2.Tooling is modified as necessary to produce components to specification.</p> <p>6.3.Modified tooling is re-trialled and component is produced.</p> <p>6.4.Conformance to specification is verified and reported according to standard operating procedures.</p> <p>6.5.Where necessary all deviations or modifications to original tooling design, prints or plans are recorded and reported according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant drawings, prints and/or sample components, specifications and instructions
- sketching or drawing the tool design
- incorporating mounting requirements into the tooling design
- testing tooling materials for hardness
- preparing sequential plan for the manufacture of the required tooling
- shaping/producing tooling components to specifications using appropriate machines and machining processes
- using hand and hand held power tools to fashion/ manufacture tooling components to specification
- assembling and fitting tooling components using acceptable tool making techniques and procedures
- producing first-off component/product
- checking first-off component/product for conformance to specification
- modifying tooling using appropriate tool making techniques and procedures
- checking conformance of the component/product to specifications
- recording/reporting modifications or alterations to original tooling design

#### Required knowledge

Look for evidence that confirms knowledge of:

- customers' tooling requirements
- the type of tooling to be manufactured
- the machine(s) in which the tooling is to be used
- the tooling design concept in terms of customer specifications and proposed production machine(s)
- the performance requirements of the tooling
- the method of mounting the tooling in the production machine into which it is to be installed
- the physical properties of a range of tool steels
- the appropriate materials for each component of the tooling to be produced
- the reasons for selecting the chosen materials in terms of strength, durability, component finish, heat treatment requirements, and availability
- the procedures for hardness testing materials
- the effect of material hardness on machinability of the material
- the appropriate machinery and tools to be used to fashion or shape tooling



## REQUIRED SKILLS AND KNOWLEDGE

components

- the reasons for selecting the chosen machinery and tooling
- the reasons for establishing a sequential plan for the manufacture of tooling
- the procedures for documenting plans for the manufacture of tooling
- the hand and hand held power tools to be used to fashion/manufacture the required tooling components
- the reasons for selecting the chosen hand and hand held power tools
- procedures for fitting/assembling the tooling components
- the precautions to be taken when fitting/assembling tooling components
- the appropriate precision instruments for checking the components produced
- the specifications of the finished product
- causes of any non-conformance to specification
- the tool making techniques/procedures to be applied to return the tooling to specification
- procedures for reporting/recording the conformance of the component/product produced by the tooling to specifications
- procedures for recording/reporting modifications and/or alterations to tooling design
- hazards and control measures associated with the manufacture of tools and gauges, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to manufacture press tools and gauges. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with press tool and gauge manufacture or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and

**RANGE STATEMENT**

regional contexts) may also be included.

**Tooling**

Press tools, jigs, fixtures, gauges, special purpose machines and equipment

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Maintenance and diagnostics

## MEM18015B Maintain tools and dies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers identifying and analysing defects in tooling, disassembling and assessing tooling components, manufacturing or repairing tooling components to conform to specifications, and assembling tooling components.</p> <p>Potential production/maintenance problems are also identified. The tooling being maintained may include press tools, plastic moulds, forging dies, die casting or jigs and fixtures and gauges etc. requiring precision repair.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This standard may be applied in a tool room situation which involves a great deal of autonomy based on a sound knowledge of the operation of production tooling.</p> <p>The tooling being maintained may include any of the following: press tools, plastic moulds, forging dies, die casting, or jigs and fixtures, gauges etc. requiring precision repair.</p> <p>A normal range of tool room equipment would be used which may include lathes, mills, grinders, hand and power tools used for precision work.</p> <p>For simple maintenance not requiring precision repair, see Unit MEM18006C (Repair fit engineering components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing
	MEM07005C	Perform general machining
	MEM07006C	Perform lathe operations
	MEM07007C	Perform milling operations
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify and analyse defects in tooling	1.1. Defects are determined from any of: production components produced, production reports or tool inspections. 1.2. Sequence of maintenance operations is planned.
2. Disassemble and assess tooling components	2.1. Tooling is disassembled, and condition of components against prints, drawings, manufacturers' drawings etc. is assessed. 2.2. Worn/damaged parts are replaced/reconditioned.
3. Obtain and prepare replacement materials	3.1. Materials are obtained to meet tooling requirements.
4. Manufacture/repair tooling components	4.1. Appropriate hand and hand held power tools are selected and used. 4.2. Appropriate machining process is chosen from a range of standard tool room machines. 4.3. Machining parameters are set to produce components to specification. 4.4. Where appropriate, heat treatment is initiated according to specification.
5. Assemble tooling components	5.1. Using acceptable tool making techniques and procedures, tooling components are checked and assembled correctly in conformance with specifications.
6. Measure production components	6.1. Production components are checked with precision instruments to ensure conformance to specifications as required.
7. Identify potential	7.1. Conditions leading to tooling failure are identified

ELEMENT	PERFORMANCE CRITERIA
production/maintenance problems	and recorded. 7.2.Recurrent faults are identified and solutions are initiated.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining all relevant information with respect to defective tooling
- examining the defective tooling for breakage, wear, etc.
- preparing a sequential plan for the repair/maintenance of the defective tooling and documenting the plan
- disassembling the defective tooling in accordance with acceptable tool making techniques and procedures
- obtaining all relevant drawings, specifications and sample products/components
- marking worn/damaged components for repair or replacement
- testing tooling components for hardness
- obtaining the appropriate materials for manufacture of replacement tooling components
- using the appropriate hand and hand held power tools to fashion/manufacture tooling components to specification
- utilise sample components or sections to test the tooling components being manufactured
- shaping and producing the tooling components to specifications using appropriate machines and machining processes
- assembling and fitting all tooling components to specification using acceptable tool making techniques and procedures
- checking the first-off component/product using appropriate precision instruments for conformance to specification
- recording the conditions that lead to the failure of the given set of tooling
- initiating design modifications/alterations to rectify recurring faults or failure

#### Required knowledge

Look for evidence that confirms knowledge of:

**REQUIRED SKILLS AND KNOWLEDGE**

- common tooling defects from a range of sample products/components
- the probable causes of tooling failure
- the reasons for selecting the probable causes of tooling failure
- the reasons for establishing a sequential plan for the repair/maintenance of defective tooling
- the procedures for documented plans for the repair/ maintenance of defective tooling
- the procedures for disassembling defective tooling
- the specifications of all tooling components
- the precision instruments to be used to check tooling components for conformance to specification
- the reasons for selecting the chosen precision instruments
- the procedures for identifying worn/damaged tooling
- components for repair or replacement
- the reasons for deciding to repair or replace worn/damaged components
- the appropriate materials for each component of the tooling to be replaced
- the required physical properties of the tooling to be replaced
- the reasons for selecting the chosen materials in terms of: strength, durability, component finish, heat treatment requirement, and availability
- the procedures for hardness testing materials
- the procedures for obtaining tooling materials
- the hand and hand held power tools to be used to fashion/manufacture the required tooling components
- the reasons for selecting the chosen hand and hand held power tools
- the appropriate machines and machining processes to shape/produce the required tooling components
- the reasons for selecting the chosen machines and machining processes
- the effect of machining parameters on the surface finish and tolerances achievable from machining processes
- the machining parameters appropriate to given machining tasks and specifications
- the reasons for selecting the chosen machining parameters
- the reasons for heat treating the tool steel in accordance with heat treatment procedures and specifications
- the heat treatment of tooling components initiated
- the heat treatment requirements of a range of given tool steels to achieve specified hardness
- the procedures for heat treating tool steels
- the procedures for initiating the heat treatment of tool steels
- the procedures for fitting/assembling the tooling components
- the precautions to be taken when fitting/assembling tooling components
- the appropriate precision instruments for checking the components produced



**REQUIRED SKILLS AND KNOWLEDGE**

- the specifications of the finished product
- the common causes of tooling failure
- the procedures for documenting tooling failures
- the conditions leading to the failure of a given set of tooling
- the reasons for selecting the chosen mode of failure
- previous faults with the given set of tooling
- any commonalities of causes of failures or trends/events associated with tooling failure
- appropriate proposed solutions for a range of recurrent faults that may occur in tooling
- the reasons for selecting the chosen solutions
- the procedures for initiating modifications/alterations to tooling design

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain tool and dies. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with tool and die maintenance or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	

**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18016B Analyse plant and equipment condition monitoring results

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers analysing condition monitoring results and developing recommendations based on the analysis. The data analysed is generated by a continuous plant and equipment condition monitoring program.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is intended to apply to the analysis of data generated by a continuous plant and equipment condition monitoring program. The analysis of condition monitoring and production of recommendations is undertaken autonomously. Recommendations may be in writing or verbal. If production of formal reports is required, then appropriate communication units should be accessed.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Analyse condition monitoring results	<p>1.1. Records/graphs/results of condition monitoring are examined and analysed and problem areas are identified.</p> <p>1.2. Necessary calculations/computations are undertaken.</p> <p>1.3. Appropriate reports/determinations of analyses are undertaken to prescribed site procedure.</p>
2. Develop recommendations	<p>2.1. Recommendations are developed based on previous history, results, specifications and legislative requirements.</p> <p>2.2. Recommendations are reported to appropriate authority.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining results of condition monitoring of plant/equipment
- performing calculations to analyse condition monitoring data
- preparing reports based on the analysis of the condition monitoring data
- reporting recommendations to the appropriate authority
- orally reporting routine information

#### Required knowledge

Look for evidence that confirms knowledge of:

- the operational specifications of the plant/equipment being monitored
- any trends and/or deviations from operational specifications
- numerical operations and calculations/formulae for data analysis within the scope of this unit
- the reasons for undertaking the identified calculations

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for reporting the analysis of condition monitoring data
- the previous history of the plant/equipment being monitored
- any relevant legislative requirements
- the operational specifications of the plant/equipment
- the recommendations with respect to action to be taken
- the reasons for the recommendations made
- the expected effect of the recommendations on the operational performance of the plant/equipment
- the procedures for reporting recommendations
- the authority/person to whom the recommendations are to be made

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to analyse plant and equipment condition monitoring results. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with analysing plant and equipment condition monitoring results or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	



**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance&diagnostics
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## MEM18017C Modify mechanical systems and equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining the requirements of the modification, undertaking the modification and evaluating the modified mechanical system/equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to significant modifications to plant and equipment that lead to desired changes in performance. Maintenance schedules are required for mechanical machines and systems, including stationary, stand-alone machines, and manual, semi-automatic and automatic process systems. This unit applies to existing equipment or the installation of new or replacement equipment.</p> <p>Where drafting skills to Australian Standard 1100 are required, see Unit MEM09003B (Prepare basic engineering drawing).</p> <p>Where minor modifications are required, see Units MEM18055B (Dismantle, replace and assemble engineering components) or MEM18006C (Repair and fit engineering components)</p> <p>Where balancing equipment is required, Unit MEM18008B (Balance equipment) should also be selected.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18005B	Perform fault diagnosis, installation and removal of bearings
	MEM18006C	Repair and fit engineering components
	MEM18007B	Maintain and repair mechanical drives and mechanical transmission assemblies
	MEM18009B	Perform levelling and alignment of machines and engineering components
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18011C	Shut down and isolate machines/equipment

<b>Prerequisite units</b>		
	MEM18016B	Analyse plant and equipment condition monitoring results
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine modification requirements	1.1.Maintenance reports and system output information are analysed. 1.2.Defective components, sub-assemblies and design faults are identified. 1.3.Corrective action plan is developed.
2. Undertake standard modifications to mechanical systems and equipment	2.1.Modification options for overcoming parts failures and design faults are identified. 2.2.Failed components and sub-assembly replacements are selected from manufacturers' catalogue. 2.3.Modification designs are developed in conjunction with and approved by appropriate authority.

ELEMENT	PERFORMANCE CRITERIA
	2.4.Modification is recorded according to standard operating procedures
3. Evaluate modified mechanical system/equipment	3.1.Alterations are evaluated for effectiveness and efficiency. 3.2.Effectiveness/efficiency is reported and recorded. 3.3.Results are checked against specifications. 3.4.Additional modification/changes, if required, are recommended.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, reading, interpreting and following information on relevant maintenance reports, production data, drawings, circuits, condition monitoring data, specifications, instructions, etc.
- analysing reports and other relevant information
- developing and planning corrective action plans
- inspecting plant/equipment for correct location, alignment, operation, performance and conformance to specifications
- documenting and approving planned modifications
- preparing and authorising drawings of the modified components and/or sub-assemblies
- recording approved modifications undertaken
- operating and monitoring performance of modified plant/equipment to ensure conformance with the required performance specifications
- reporting/recording efficiency/effectiveness of the modifications undertaken
- recommending further modifications to the plant/equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- the desired changes in performance of the plant/equipment
- the specifications of the plant/equipment and its performance requirements
- the procedures for inspecting the plant/equipment against specifications

**REQUIRED SKILLS AND KNOWLEDGE**

- where appropriate, defective components, sub-assemblies and design faults
- the effect of defective components, sub-assemblies and design faults on the performance of plant/equipment
- the action to be taken to achieve the desired changes in performance
- the reasons for taking the action identified
- the procedures for documenting the proposed modifications to the plant/equipment
- the authority from whom approval to undertake the proposed modifications is to be obtained
- typical part failure modes and the causes
- the action to be taken to correct part failures and design faults
- for given part failures and/or design faults, the options for modifying the plant/equipment
- for given components and/or sub-assemblies, appropriate standard replacements from manufacturers'/suppliers' catalogues
- the procedures for modifying drawings of components and/or sub-assemblies
- the procedures for authorising changes made to drawings of plant/equipment
- the procedures for recording modifications undertaken
- the procedures for checking the operation of the modified plant/equipment against required performance specifications
- procedures to report/record the effectiveness/efficiency of the modifications
- the tests to be undertaken to check the performance of the modified plant/equipment
- engineering design and drawing skills associated with modifying mechanical systems and equipment
- numerical operations, geometry and calculations/formulae within the scope of this unit
- hazards and control measures associated with modifying mechanical systems and equipment
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to modify mechanical systems and equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying mechanical systems and equipment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Analysed</b>	Interpretation and integration of data from consultations, process control instrumentation and condition monitoring systems, etc.
<b>Modifications</b>	Changes to plant and equipment which lead to desired changes in performance

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18018C Maintain pneumatic system components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking pneumatic system components, and identifying and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>Pneumatic system components are identified, inspected and assessed using fluid power principles to predetermined specifications interpreted from data sheets and circuits diagrams.</p> <p>Work is undertaken using predetermined standards of safety, quality and work procedures.</p> <p>Correct operational function of equipment components is confirmed and commissioned in conformance with specification, using standard operating procedures.</p> <p>For straightforward removals/replacement of components from a pneumatic system, Unit MEM18055B (Dismantle replace and assemble engineering components) or Unit MEM18071B (Connect/disconnect fluid conveying system components) should be regarded as sufficient.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Check pneumatic system components	1.1. System components are identified correctly. 1.2. The characteristics and operational function of each system component are understood. 1.3. The operational function of each component is inspected and tested. 1.4. Correct operation of each component is assessed against specifications.
2. Identify, repair or replace faulty pneumatic system components	2.1. Faulty system components are localised and malfunction is confirmed by inspection and testing using fluid power principles, procedures and safety requirements. 2.2. Faulty system components are dismantled and repaired to manufacturers'/site specifications. 2.3. Replacement parts are selected from manufacturers' catalogue according to required specifications. 2.4. System components are reassembled and verified for correct operation and tested against specifications. 2.5. Correct operation of the pneumatic system is confirmed to standard operating procedures. 2.6. Appropriate follow-up procedures are adopted according to standard operating procedures. 2.7. Where appropriate, service reports are completed using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- inspecting and testing pneumatic system components
- obtaining, interpreting and following written job instructions, specifications, standard operating procedures, charts, lists, drawings, relevant data sheets and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

## REQUIRED SKILLS AND KNOWLEDGE

- checking individual components within the pneumatic system for correct operation
- dismantling and repairing faulty system components
- selecting replacement parts from manufacturers'/suppliers' catalogues
- assembling pneumatic system components
- testing pneumatic components for correct operation and conformance to specifications
- checking the operation of the pneumatic system for conformance to specification
- checking repaired/replaced pneumatic system components for correct operation
- completing service reports

## Required knowledge

Look for evidence that confirms knowledge of:

- the full range of pneumatic system components
- characteristics/operational function of each component
- procedures for inspecting and testing pneumatic system components
- equipment to test pneumatic system components
- the specifications of each pneumatic system component
- faulty system components
- causes of faulty pneumatic components
- individual components within the pneumatic system
- the safety procedures for working on pneumatic components
- the procedure for repairing pneumatic system components
- procedures for checking pneumatic system operation
- follow-up procedures with respect to repaired/replaced pneumatic system components
- reporting/recording procedures
- hazard and control measures associated with maintaining pneumatic system components, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to maintain pneumatic system components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining pneumatic system components or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Pneumatic system components</b>	Static and dynamic seals, linear and semi-rotary actuators, pressure control valves, directional control valves, flow control valves, normally open and closed timers, counters, pneumatic motors, fluid conductors and other associated equipment
<b>Repair/replace</b>	Repairs and replacements are conducted to site or manufacturers' specifications

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18019B Maintain pneumatic systems

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking preventive maintenance checks/adjustments on pneumatic systems, and fault finding, replacing, repairing or overhauling, and recommissioning pneumatic systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>The use of hand tools, power tools and specialist tools is included. Work tasks include preventative maintenance; testing diagnostic fault finding; adjustment, repair, replacement and overhauling of pneumatic systems to predetermined standards of quality, safety and work practices and procedures.</p> <p>Pneumatic components are identified, inspected and correct operational function is assessed using fluid power principles to predetermined specifications, interpreted from data sheets, manufacturers' catalogues, circuit diagrams and engineering drawings.</p> <p>Tests, checks, adjustments, repair, replacement and overhaul are undertaken on pneumatic assemblies/sub-assemblies, stationary/mobile equipment, pneumatic power tools according to site or manufacturers' specifications. Appropriate follow-up procedures are instigated, adopted and appropriate documentation is maintained.</p> <p>Work is undertaken autonomously or in a team environment.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p>
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	<b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18018C	Maintain pneumatic system components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventative maintenance checks/adjustments on pneumatic systems	<p>1.1. System components, assemblies or sub-assemblies are identified and prepared for inspection/preventative maintenance.</p> <p>1.2. Visual inspection and testing with appropriate test equipment are carried out according to fluid power principles, procedures and safety requirements.</p> <p>1.3. Scheduled preventative maintenance tasks are performed including obvious repairs and adjustments according to manufacturers' specification using fluid power techniques/practices.</p>
2. Undertake fault finding on pneumatic systems	<p>2.1. Designated pneumatic system components are identified and a visual inspection of the system is carried out for the collection of fault finding data.</p> <p>2.2. System operator is consulted where appropriate and additional data is collected.</p> <p>2.3. Maintenance reports and preventative maintenance schedules are checked and reviewed for additional fault finding data.</p> <p>2.4. Using fluid power principles, checks and tests are undertaken using appropriate test equipment and techniques.</p> <p>2.5. Faults and malfunctions are identified and verified.</p> <p>2.6. Faults and malfunctions are documented or reported by appropriate means to designated personnel and actioned.</p>
3. Repair and/or overhaul pneumatic power system	<p>3.1. System or sub-assembly is isolated safely and residue pressure is discharged in accordance with prescribed procedures or checked for correct isolation.</p> <p>3.2. Isolated system or sub-assembly is tagged according</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>to designated means.</p> <p>3.3. Component or sub-assembly is removed from system using correct removal principles and techniques.</p> <p>3.4. Components or sub-assemblies are dismantled, examined and verified for replacement, overhaul or repair, using correct and appropriate techniques and procedures.</p> <p>3.5. Replacement items are selected from manufacturers' catalogues to meet specifications</p> <p>3.6. Faulty items are repaired/replaced/overhauled, using correct and appropriate principles, techniques and procedures.</p> <p>3.7. Component or sub-assembly items are refitted to equipment and tested for correct operation assessed against specifications.</p>
4. Recommission pneumatic system	<p>4.1. System or sub-assembly is recommissioned according to prescribed procedures and specifications.</p> <p>4.2. Using fluid power principles and system application techniques, correct operation of the system is verified.</p> <p>4.3. Appropriate follow-up procedures are instigated.</p> <p>4.4. Maintenance records/service reports are updated and completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing pneumatic system components for inspection/preventative maintenance
- inspecting and testing pneumatic system and components
- performing scheduled preventative maintenance tasks
- performing repairs on the pneumatic system/components as required
- visually inspecting pneumatic system and its components for indications of

**REQUIRED SKILLS AND KNOWLEDGE**

- correct/incorrect operation
- consulting system operator with respect to the fault being investigated
- obtaining and interpreting maintenance reports and preventative maintenance schedules
- checking/testing pneumatic system/component operation
- verifying/confirming apparent faults/malfunctions
- documenting or reporting verified faults/malfunctions
- initiating repair/overhaul of the pneumatic system
- isolating and depressurising pneumatic system
- checking pneumatic system to ensure isolation and depressurisation
- tagging isolated pneumatic system
- removing pneumatic components/sub-assembly from the system
- dismantling pneumatic components/sub-assemblies
- examining pneumatic components/sub-assemblies and their parts for conformance to specification
- selecting replacement parts selected from manufacturers' catalogues
- overhauling faulty items
- refitting pneumatic component/sub-assembly into the system
- testing pneumatic component/sub-assembly for correct operation
- recommissioning pneumatic system/sub-assembly to specification
- checking/testing pneumatic system/sub-assembly for correct operation
- initiating follow-up procedures
- updating and completing maintenance records/reports

**Required knowledge**

Look for evidence that confirms knowledge of:

- common pneumatic system components
- pneumatic system/component faults that can be determined by visual inspection
- the application of common pneumatic system/component test equipment
- scheduled preventative maintenance tasks
- manufacturers' specifications
- common pneumatic system and component faults
- any previous faults in the pneumatic system/components
- any previous maintenance carried out on the pneumatic system/components
- typical checks/tests that can be carried out on pneumatic systems/components and their application
- pneumatic system/component tests and testing techniques
- apparent faults/malfunctions
- documentation/reporting requirements with respect to verified faults/malfunctions
- procedures for initiating repair and/or overhaul of the pneumatic system

**REQUIRED SKILLS AND KNOWLEDGE**

- hazards associated with working on pneumatic systems/components, including housekeeping
- the procedures for isolating and depressurising pneumatic systems
- the tagging requirements for isolated systems
- the structure of typical pneumatic components
- specifications of pneumatic components and their constituent parts
- reasons for deciding to repair, replace or overhaul pneumatic components
- system recommissioning procedures
- the pneumatic system operational specifications
- any appropriate follow-up maintenance or operational checks
- maintenance recording/reporting requirements
- consequences of inaccurate or incomplete recording/reporting of maintenance/service activities
- pneumatic principles
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain pneumatic systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

**EVIDENCE GUIDE**

	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and repairing pneumatic systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preventative maintenance checks</b>	Preventative maintenance is undertaken on a periodic basis and appropriate documentation is maintained
<b>Systems</b>	For the purposes of this unit, a system is regarded

<b>RANGE STATEMENT</b>	
	as a functionally related group of elements. The unit extends to tests involving interacting, interrelated, or interdependent components
<b>Test equipment</b>	Leak testers, escape rate gauges, hand held pressure testers and other appropriate equipment
<b>Repair</b>	Rectify, replace components, determine for reuse

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18020B Maintain hydraulic system components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking hydraulic system components, and identifying and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>Hydraulic system components are identified, inspected and assessed using fluid power principles to predetermined specifications interpreted from data sheets and circuits diagrams.</p> <p>Work is undertaken using predetermined standards of safety, quality and work procedures. Repairs and replacements are undertaken to site or manufacturers' specifications. Correct operational function of equipment components is confirmed and commissioned in conformance to specifications, using standard operating procedures.</p> <p>For straightforward removals/replacement of components from a hydraulic system, Unit MEM18055B (Dismantle replace and assemble engineering components) or Unit MEM18071B (Connect/disconnect fluid conveying system components) should be regarded as sufficient.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Check hydraulic system components	1.1. System components are identified correctly. 1.2. The characteristics and operational function of each system component are understood. 1.3. The operational function of each component is inspected and tested. 1.4. Correct operation of each component is assessed against specifications.
2. Identify and repair or replace faulty hydraulic system components	2.1. Faulty system components are localised and malfunction is confirmed by inspection and testing using fluid power principles, procedures and safety requirements. 2.2. Faulty system components are dismantled and rectified to manufacturers'/site specifications. 2.3. Replacement parts are selected from manufacturers' catalogues according to required specifications. 2.4. System components are reassembled and tested for correct operation and assessment against specifications. 2.5. Correct operation of the hydraulic system is confirmed to designated operating procedure. 2.6. Appropriate follow-up procedures are adopted according to standard operating procedures. 2.7. Where appropriate, service reports are completed using standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- inspecting a range of hydraulic system components in accordance with standard operating procedures
- reading, interpreting and following relevant data sheets, specifications, hydraulic circuits, drawings, instructions and manuals
- checking the individual components within the hydraulic system for correct

**REQUIRED SKILLS AND KNOWLEDGE**

operation

- dismantling and rectifying faulty system components to manufacturers'/site specifications in accordance with standard operating procedures
- where appropriate, selecting replacement parts from the manufacturers'/suppliers' catalogues
- reassembling and testing the hydraulic system components
- checking the operation of the hydraulic system for conformance to specification
- checking repaired/replaced hydraulic system components for correct operation
- completing service reports where appropriate

**Required knowledge**

Look for evidence that confirms knowledge of:

- the full range of hydraulic system components
- characteristics and operational function of each hydraulic system component
- procedures for inspecting and testing hydraulic system components
- equipment required to test hydraulic system components
- specifications of each hydraulic system component
- hydraulic components not operating in accordance with specifications
- reasons for hydraulic components not operating in accordance with specification
- individual components within the hydraulic system
- safety procedures to be followed when working on hydraulic components
- where appropriate, faulty system components
- procedure for repairing hydraulic system components
- parts to be replaced
- reasons for replacing the parts identified
- the correct operation of the hydraulic system
- procedures for checking hydraulic system operation
- where appropriate, the follow-up procedures with respect to repaired/replaced hydraulic system components
- reporting/recording procedures
- reasons for completing service reports for hydraulic system components repaired/replaced
- hazards associated with maintaining hydraulic system components, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain hydraulic system components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining hydraulic system components or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Hydraulic system components**

Hydraulic system components may include static and dynamic seals, linear and semi-rotary actuators, fixed displacement and variable displacement pumps, pressure control valves, directional control valves, flow control valves, hydraulic motors, reservoirs, contamination control components (filtration), fluid conductors/fittings and other associated equipment.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18021B Maintain hydraulic systems

### Modification History

Single Band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking preventive maintenance checks/adjustments on hydraulic systems, and fault finding, repairing, rectifying or overhauling, and recommissioning hydraulic systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>The use of hand tools, power tools and specialist tools is included. Work tasks include the preventative maintenance, testing, diagnostic fault finding, adjustment, repair, replacement and overhauling of hydraulic systems to predetermined standards of quality, safety and work practices and procedures.</p> <p>Hydraulic components are identified, inspected and correct operational function is assessed using fluid power principles to predetermined specifications, interpreted from data sheets, manufacturers' catalogues, circuit diagrams and engineering drawings.</p> <p>Appropriate follow-up procedures are instigated, adopted and appropriate documentation is maintained.</p> <p>Work is undertaken autonomously or in a team environment.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18020B	Maintain hydraulic system components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventative maintenance checks/adjustments on hydraulic systems	<p>1.1. System components, assemblies or sub-assemblies are identified and prepared for inspection/preventative maintenance.</p> <p>1.2. Visual inspection and testing with appropriate test equipment are carried out according to fluid power principles, procedures and safety requirements.</p> <p>1.3. Scheduled preventive maintenance tasks are performed including obvious repairs and adjustments according to manufacturers' specifications using fluid power techniques/practices.</p>
2. Undertake fault finding on hydraulic systems	<p>2.1. Designated hydraulic system components are identified and a visual inspection of the system is carried out for the collection of fault finding data.</p> <p>2.2. System operator is consulted where appropriate and additional data is collected.</p> <p>2.3. Maintenance reports and preventative maintenance schedules are checked and reviewed for additional fault finding data.</p> <p>2.4. Using fluid power principles, checks and tests are undertaken using appropriate test equipment and techniques.</p> <p>2.5. Faults and malfunctions are identified and verified.</p> <p>2.6. Faults and malfunctions are documented or reported by appropriate means to designated personnel and actioned.</p>
3. Repair and/or rectify hydraulic system	<p>3.1. System or sub-assembly is isolated safely and residue pressure is discharged in accordance with prescribed procedure and checked for correct isolation.</p> <p>3.2. Isolated system or sub-assembly is tagged according to designated means.</p> <p>3.3. Components or sub-assembly is removed from system using correct removal principles and techniques.</p> <p>3.4. Components or sub-assemblies are dismantled, examined and verified for replacement, overhaul or repair, using correct and appropriate techniques and</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>procedures.</p> <p>3.5.Replacement items are selected from manufacturers' catalogues to meet specifications.</p> <p>3.6.Faulty items are rectified using correct and appropriate principles, techniques and procedures.</p> <p>3.7.Component or sub-assembly items are refitted to equipment and tested for correct operation against specifications.</p>
4. Recommission hydraulic system	<p>4.1.System or sub-assembly is recommissioned according to prescribed procedures and specifications.</p> <p>4.2.Using fluid power principles and system applications techniques, correct operation of the system is verified.</p> <p>4.3.Appropriate follow-up procedures are instigated.</p> <p>4.4.Maintenance records/service reports are updated and completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing hydraulic system components for inspection/preventative maintenance
- inspecting and testing the hydraulic system/components
- planning and sequencing operations
- performing scheduled preventative maintenance tasks
- where appropriate, performing obvious repairs on the hydraulic system/components
- visually inspect the hydraulic system and its components for indications of correct/incorrect operation
- where appropriate, consulting with the system operator with respect to the fault being investigated
- obtaining and interpreting maintenance reports and preventative maintenance schedules
- using appropriate test equipment and techniques to check/test hydraulic

**REQUIRED SKILLS AND KNOWLEDGE**

system/component operation

- verifying apparent faults/malfunctions
- documenting or reporting all verified faults/malfunctions
- initiating the repair/overhaul of the hydraulic system
- isolating and depressurising the hydraulic system
- tagging the isolated hydraulic system
- removing the hydraulic components/sub-assembly from the system
- dismantling the hydraulic components/sub-assemblies
- examining the hydraulic components/sub-assemblies and their parts for conformance to specification
- selecting replacement parts from manufacturers' catalogues in compliance with specifications
- repairing/replacing/overhauling faulty items
- refitting the hydraulic component/sub-assembly into the system
- testing the hydraulic component/sub-assembly for correct operation and compliance with specifications
- recommissioning the hydraulic system/sub-assembly to specification
- checking/testing the hydraulic system/sub-assembly for correct operation
- where appropriate, initiating follow-up procedures
- updating and completing all maintenance records/reports

**Required knowledge**

Look for evidence that confirms knowledge of:

- common hydraulic system components
- hydraulic system/component faults that can be determined by visual inspection
- the application of common hydraulic system/component test equipment
- schedule of preventative maintenance tasks
- the manufacturers' specifications
- common hydraulic system and component faults
- any previous faults in the hydraulic system/components
- any previous maintenance carried out on the hydraulic system/components
- typical checks/tests that can be carried out on hydraulic systems/components and their application
- hydraulic system/component test and testing techniques
- apparent faults/malfunctions
- the documentation/reporting requirements with respect to verified faults/malfunctions
- the procedures for initiating repair/replacement and/or overhaul of the hydraulic system
- the hazards and control measures associated with working on hydraulic systems/components, including housekeeping

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for isolating and depressurising hydraulic systems
- tagging requirements for isolated systems
- the structure of typical hydraulic components
- the specifications of hydraulic components and their constituent parts
- the appropriate repair/overhaul procedures
- system recommissioning procedures
- the hydraulic system operational specifications
- any appropriate follow-up maintenance or operational checks
- the maintenance recording/reporting requirements
- the consequences of inaccurate or incomplete recording/reporting of maintenance/service activities
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain hydraulic systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and repairing hydraulic systems or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Preventative maintenance</b>	Preventative maintenance is undertaken on a periodic basis and appropriate documentation is maintained
<b>Systems</b>	For the purposes of this unit a system is regarded as a functionally related group of elements. The unit extends to tests involving interacting, interrelated, or interdependent components

**RANGE STATEMENT**

<b>Test equipment</b>	Leak testers, escape rate gauges, hand held pressure testers and other appropriate equipment
<b>Rectify</b>	Replacement, repair and/or reuse of components

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18022B Maintain fluid power controls

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing and repairing and/or rectifying fluid power controls, and adjusting fluid power system control sequence and operation.
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### Application of the Unit

<b>Application of the unit</b>	<p>It also covers fault finding of fluid power systems control circuits, maintaining and repairing or replacing system control components and checking and adjusting the sequence of fluid power system controls. System circuit/components are identified, traced, inspected and operational function is assessed and verified using fluid power principles to predetermined specifications interpreted from data sheets and circuit diagrams.</p> <p>Work is undertaken using predetermined standards of quality, safety and work procedures, autonomously or in a team environment.</p> <p>Installation, adjustment, repairs, replacements and overhauls are undertaken to site or manufacturers' specifications using working knowledge and application of principles of fluid power systems control sequencing which may include: PLCs, relay logic control systems, unitised/modular sensors, transducers, timers, counters and associated equipment.</p> <p>If skills beyond the sequencing of PLC controls are required, then Units MEM10004B (Enter and change programmable controller operational parameters) and/or Unit MEM10005B (Commission programmable controller programs) should also be accessed.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit</p>
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	for progression to C5 (AQF level V).
	<b>Unit Weight: 8</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18018C	Maintain pneumatic system components
	MEM18019B	Maintain pneumatic systems
	MEM18055B	Dismantle, replace and assemble engineering components
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work



Prerequisite units		
	MEM18006C	Repair and fit engineering components
	MEM18020B	Maintain hydraulic system components
	MEM18021B	Maintain hydraulic systems
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Install/replace fluid power systems and controls	<p>1.1.Fluid power control principles and system/circuit diagrams are interpreted and understood.</p> <p>1.2.System/circuit components are identified and inspected for compliance with specifications.</p> <p>1.3.Sequential installation is undertaken according to manufacturers' specifications and standard operating procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Check and adjust fluid power system control sequence and operation	<p>2.1. Controls and system operation is checked against operational specifications using appropriate test equipment and application principles/techniques.</p> <p>2.2. Adjustments are performed to sequence system to meet/align to operational requirements and specifications.</p> <p>2.3. Modifications/alterations are recorded and reported in accordance with standard operating procedures.</p> <p>2.4. Controls and system operation is checked and commissioned to specifications.</p>
3. Fault find fluid power systems control circuit	<p>3.1. System/circuit diagrams and data sheets are interpreted and understood.</p> <p>3.2. System/circuit components are identified and inspected.</p> <p>3.3. System/circuit is traced and action of components is diagnosed to identify and localise faults.</p> <p>3.4. System/circuit parts are tested using appropriate test equipment and application principles.</p> <p>3.5. System/circuit parts are assessed against operational specifications.</p> <p>3.6. Fault condition is localised at the component level.</p> <p>3.7. Faulty condition is evaluated, root cause is analysed and corrective action is planned.</p>
4. Maintain and repair or rectify system control components	<p>4.1. Correct maintenance procedures are applied according to standard operating procedures.</p> <p>4.2. Repair procedures are selected and applied using correct and appropriate techniques, tools and equipment.</p> <p>4.3. Faulty items are tested, repaired or replaced using sequential installation procedures according to manufacturers' recommendations.</p> <p>4.4. Replacement items are selected from manufacturers' catalogues to meet specifications.</p> <p>4.5. System control components are reassembled using appropriate principles and procedures according to specifications required.</p>
5. Check and adjust sequence of fluid power system controls	<p>5.1. Using circuit diagrams and fluid power system control principles, circuit sensors and controllers are identified.</p> <p>5.2. Necessary adjustments to sequence system control circuit are made to meet operational specification.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>5.3. Correct operation of system control circuit is checked against operational specification.</p> <p>5.4. Correct operation is confirmed.</p> <p>5.5. Fluid power system controls are commissioned to specifications.</p> <p>5.6. Appropriate follow-up procedures are adopted.</p> <p>5.7. Service/maintenance report is completed to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting system/circuit diagrams, system operation data sheets and control data
- planning and sequencing operations
- checking/inspecting system/circuit components for compliance with specifications
- undertaking installation of the fluid power system and controls in accordance with manufacturers' specifications and work site procedures
- using test equipment to check control and system operation against specification
- adjusting the system where appropriate, to ensure that the sequence of operations conforms to operational requirements
- recording/reporting any modifications/alterations to the system
- checking the operation of the controls and system for conformance to specification
- commissioning the system in accordance with work site procedures
- identifying and localising components not conforming to operational specification
- conducting appropriate maintenance in accordance with work site procedures
- repairing control components where appropriate
- testing faulty items for conformance to specification
- installing repaired/replaced components
- selecting replacement items from manufacturers' catalogues
- reassembling control components
- initiating maintenance and/or service follow-up procedures
- completing maintenance and/or service reports

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- system operational and control requirements and specifications
- the application of common fluid power system components and controllers
- the system/circuit components
- any special installation requirements
- fluid power test equipment and application
- the correct operational sequence of the system
- typical adjustments to correct sequencing variations from specification
- the consequences of not recording/reporting modifications to systems
- the procedures for recording/reporting modifications/alterations
- the fluid power system commissioning procedures
- common test equipment and its application
- the component(s) not complying with operational specification
- typical causes of component failure
- the cause of the faulty condition in the component(s)
- appropriate procedures for rectifying the faulty condition
- the appropriate maintenance schedule and procedures
- appropriate control component repair procedures
- typical test equipment and its application
- circuit sensors and controllers
- common adjustments that can be made to control systems and their effect
- any maintenance/service follow-up procedures
- the maintenance/service recording/reporting requirements
- hazards and control measures associated with maintaining and rectifying fluid power controls, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must

<b>EVIDENCE GUIDE</b>	
	be able to maintain fluid power controls. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and rectifying fluid power controls or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Fluid power control principles</b>	PLCs, relay logic control systems, unitised/modular sensors, transducers, timers, counters and associated equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18023B Modify fluid power system operation

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining the requirements of the modification, undertaking the modification and evaluating the modified or repaired fluid power system.
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### Application of the Unit

<b>Application of the unit</b>	<p>Tasks undertaken are based on analysis of service / maintenance reports. Work is undertaken autonomously or in a team environment.</p> <p>Using sound working knowledge and principles of fluid power systems, defective components, sub-assemblies and design faults are identified and appropriate redesign action is commissioned. This action may include replacement of components, sub-assemblies using equivalent parts lists in manufacturers' catalogues. Preparation for redesign specifications and associated drawing changes / modifications are personally undertaken or delegated to appropriate personnel and supervised.</p> <p>Where the modification requires the knowledge of PLC program installation or commissioning, then Unit MEM10004B (Enter and change programmable controller operational parameters) and Unit MEM10005B (Commission programmable controller programs) should also be selected.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18016B	Analyse plant and equipment condition monitoring results
	MEM18018C	Maintain pneumatic system components
	MEM18019B	Maintain pneumatic systems
	MEM18020B	Maintain hydraulic system components
	MEM18021B	Maintain hydraulic systems
	MEM18022B	Maintain fluid power controls
	MEM18055B	Dismantle, replace and assemble engineering components



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine modification requirements	<p>1.1. Service/maintenance reports and system output information is interpreted and analysed correctly.</p> <p>1.2. Using knowledge and principles of fluid power systems, defective components, sub-assemblies and design faults are identified.</p> <p>1.3. Defective components and design faults are verified using appropriate means and techniques.</p> <p>1.4. Corrective action plan is researched and developed in consultation with appropriate personnel.</p> <p>1.5. Modification/design options are investigated to overcome parts failure or design faults.</p> <p>1.6. Most appropriate modifications design option is developed, selected and specifications are prepared.</p>
2. Undertake modifications to fluid power systems	<p>2.1. Replacement components are selected from manufacturers catalogue to meet specifications.</p> <p>2.2. Modifications are undertaken or delegated to appropriate personnel and supervised.</p> <p>2.3. Modifications are recorded and documented according to standard operating procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Monitor and evaluate repaired or modified fluid power system	<p>3.1.Modified/repaired fluid power systems are monitored and operation system is assessed for compliance with operational specifications.</p> <p>3.2.Modifications/repairs are evaluated for effectiveness, efficiency and compliance with operational specifications.</p> <p>3.3.Where applicable, further corrective action is recommended to appropriate personnel, instigated and monitored until desired efficiencies/outcomes are achieved.</p> <p>3.4.Evaluation reports are completed to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining, interpreting and analysing service/maintenance reports and system output information
- planning and sequencing operations
- checking and testing components/sub-assemblies for conformance to specification
- confirming design faults
- obtaining relevant information with respect to the modification requirements
- developing an appropriate action plan to overcome system problems
- undertaking modifications to fluid power systems where appropriate
- delegating work to appropriate personnel where appropriate and supervising work
- recording/reporting modifications to the fluid power system
- checking the operation of the modified/repaired fluid power system for compliance with operational specifications
- initiating and monitoring further corrective action, where applicable
- confirming that desired outcomes are achieved
- preparing evaluation reports on the modifications/repairs

#### Required knowledge

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms knowledge of:

- fluid power system performance, faults history and variations from operational specification
- faults attributable to poor design
- defective components/sub-assemblies
- appropriate test equipment and applications
- techniques for verifying design faults
- personnel to be consulted during the modification process
- sources of information relevant to the modification requirements
- the specifications pertaining to the selected modification/design option
- the modification/design options available to overcome system faults
- the cost and benefits associated with the available options
- the most appropriate modification/design option
- the procedures for undertaking the selected modification/design option
- replacement components conforming to predetermined specifications from manufacturer's catalogues
- the modifications to be undertaken
- the requirements for recording/reporting modifications to fluid power systems
- the revised operational specification of the fluid power system
- the frequency of checks for compliance against operational specifications
- the effectiveness and efficiency of the modifications/repairs
- any variations from operational specifications
- any further modifications/repairs that could improve the effectiveness and efficiency of the fluid power system
- personnel to whom recommendations are to be made
- the appropriate reporting requirements
- hazards and control measures associated with modifying fluid power system operation, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to modify fluid power system operation Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying fluid power system operation or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Modification</b>	Modifications covered by this unit are changes to fluid power systems and equipment that lead to desired changes in system performance
<b>Analysed</b>	Interpretation and integration of data from process controls, instrumentation and condition monitoring systems and consultation with appropriate personnel

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance&diagnostics
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## MEM18024B Maintain engine cooling systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing cooling system operation, and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>Cooling system testing would typically require the person to obtain air and/or water flows, temperatures and pressures; assess serviceability; and repair a range of flow/pressure regulators, sensors, actuators and solenoids on shutter type systems or fan drives, or on water type inter/after coolers and oil coolers.</p> <p>Typical symptoms of faults would be coolant pressures and the presence of steam, gases, oil, fuel or air. This unit would typically apply to engine or vehicle cooling systems. On large stationary plant, cooling systems may include the use of cooling towers.</p> <p>All is work undertaken to manufacturers specifications and standard operating procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess cooling system operation	1.1.Heat transfer characteristics, water treatment, and corrosion principles and terminology are understood. 1.2.Relevant information is obtained and correctly interpreted prior to any testing. 1.3.System checks are undertaken safely and to



ELEMENT	PERFORMANCE CRITERIA
	<p>prescribed procedures.</p> <p>1.4. Water/air flows, pressures and temperatures are correctly determined and recorded.</p> <p>1.5. Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.6. Test equipment is adapted and used correctly.</p> <p>1.7. Coolant test samples are correctly obtained and tested.</p> <p>1.8. Component parts are correctly assessed for reuse or replacement.</p>
2. Rectify faulty components	<p>2.1. Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p> <p>2.2. Replacement components are correctly selected for application using manufacturers' data.</p> <p>2.3. Components are removed and refitted to engine by following prescribed procedures.</p> <p>2.4. Test and repair/replacement activities are accurately recorded.</p> <p>2.5. Engine is free of coolant leaks and the cooling system contains the correct level of additive/inhibitor after repair work is carried out.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable documents
- planning and sequencing operations
- checking and clarifying task-related information
- checking the cooling system safely and in accordance with standard operating procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- accurately measuring and recording water/air flows, pressures and temperatures of the cooling system
- identifying faulty component(s)
- adapting test equipment for use on the cooling system being tested
- obtaining and interpreting coolant test samples
- checking cooling system components for wear and clearances using appropriate equipment
- testing coolant condition including anti-corrosion, anti-freezes etc.
- interpreting relevant specifications, parts lists, catalogues etc.
- obtaining replacement parts
- removing and refitting cooling system components
- undertaking test and repair/replacement activities on the cooling system
- testing the engine for coolant leaks after repair
- checking for conformance to specifications
- undertaking calculations and numerical operations within the scope of this unit
- reporting and documenting task related information

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles of heat transfer as applied to cooling systems
- the effect of water treatment and corrosion on the effectiveness of cooling system operation
- the components of the cooling system and their function
- the checks and procedures to be carried out on cooling systems
- hazards and control measures associated with testing cooling systems, including housekeeping
- the procedures for measuring water/air flows, pressures and temperatures in cooling systems
- the necessary tools, techniques and equipment to carry out the above tests
- variations of test results from specifications and the likely causes of those variations
- the appropriate corrective action to be taken when variations are identified
- the precautions to be taken when adapting test equipment
- the procedures, tools, techniques and equipment for testing coolant test samples
- the reasons for identifying faulty components for repair or replacement
- the procedures for testing components for wear and clearances and the appropriate measuring/test equipment
- the procedures for obtaining replacement parts
- the procedures for removing/replacing cooling system components from the engine
- the procedures for checking coolant levels and engine coolant leaks
- the correct amount of additive/inhibitor to be added to the coolant

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for recording test and rectification
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain and rectify engine cooling systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and rectifying engine cooling systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Tested</b>	Includes testing for coolant condition i.e. correct, anti-corrosion, antifreezes etc.
<b>Component</b>	Sensors, caps, gauges, pumps, fan drive belts etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18025B Service combustion engines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking and assessing engine consumable fluids and components for serviceability, performing the servicing procedures and reporting what has been done.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the assessment and replacement of engine consumable fluids and components and the carrying out of servicing activities to predetermined procedures or manufacturers' specifications, including minor running adjustments.</p> <p>Servicing activities may include obtaining and dispatching samples for spectrographic or laboratory analysis. Adjustments are limited to 'running adjustments' typical of which are belt tensions, shroud clearances, linkage adjustments, etc.</p> <p>This unit should not be selected if Unit MEM18055B (Dismantle, replace and assemble engineering components) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check and assess items for serviceability	1.1.Engine consumable fluids and components are correctly assessed for condition. 1.2.Replacement fluids/items are correctly identified using manufacturers' data. 1.3.Abnormal appearance/condition of engine consumables fluids and components is identified and reported to appropriate authority. 1.4.Lubricant, cooling system additives and filtering principles are understood.
2. Perform servicing procedures	2.1.Engine fluids are drained, flushed and replaced with correct fluid and/or additives, and to the correct level/concentration according to manufacturers'

ELEMENT	PERFORMANCE CRITERIA
	<p>recommendations.</p> <p>2.2.Engine consumable components are removed and replaced according to manufacturers' recommended procedures.</p> <p>2.3.Engine is free of lubricant, water and air leaks after servicing work.</p> <p>2.4.Hoses, wiring, ducts etc. are correctly secured and clear of moving parts after servicing work.</p> <p>2.5.Minor running adjustments are made to specification.</p> <p>2.6.Test samples of fluids are correctly obtained from system as determined by standard operating procedures.</p>
3. Report activities	3.1.Servicing activities are accurately recorded on report sheet/proforma, or accurate oral report is given.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- checking items removed from the engine for serviceability and conformance to specifications
- planning and sequencing operations
- checking task-related information
- identifying and reporting on fluids and items which have abnormal appearance
- flushing engine fluids from the engine and cleaning the engine of any residual fluids
- replacing engine fluids with the correct fluids to the correct levels
- removing and replacing engine consumable fluids and components
- checking the engine for lubricant, water and air leaks after servicing
- securing wires, hoses and ducts after servicing



**REQUIRED SKILLS AND KNOWLEDGE**

- making minor running adjustments
- obtaining test samples
- undertaking calculations and numerical operations within the scope of this unit
- recording and reporting service activities

**Required knowledge**

Look for evidence that confirms knowledge of:

- common defects that can be identified from the appearance of fluids and items
- the procedures for reporting items/fluids with abnormal appearance
- the principles of operation of the lubrication and cooling systems
- the function of filters
- the purpose of a range of additives
- the procedures for draining and flushing fluids from the engine including the reasons for ensuring any residual/spilt fluids are removed from the engine
- the appropriate grade and type of replacement fluid
- the procedures for replacing engine fluids
- the correct proportions of additive to be used
- the procedures for removing/replacing engine consumable fluids and components
- the procedures for checking serviced engines for leaks
- the methods of fastening/securing wires, hoses, ducts, etc.
- the procedures for undertaking minor running adjustments
- the specifications pertaining to those adjustments
- the procedures for taking test samples
- the procedures for reporting service activities
- hazards and control measures associated with servicing combustion engines
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service combustion engines. Competency in this unit cannot be claimed until all prerequisites have

<b>EVIDENCE GUIDE</b>	
	been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with servicing combustion engines or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Engine consumable fluids and components</b>	These include components and fluids that are designed to be replaced or restored as their effectiveness diminishes, or where they are wearing/failing. Typically they would include filters, coolants, lubricants, hydraulic and other fluids, additives etc, simple drive belts and coolant hoses
<b>Running adjustments</b>	These are limited to straightforward adjustments typical of which are belt tensions, shroud clearances, linkage adjustments, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18026C Test compression ignition fuel systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing operation of compression ignition fuel systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>Operation of plant and equipment would be performed within the person's licensing limits or as determined by relevant regulations. This unit applies to work conducted on any diesel fuel system - the tank, filters, pump, injectors and governors. Replacement would require the person to time the high-pressure fuel pump or injectors to engine. Final adjustment may include the setting of low/high or no load/full load speed and/or droop, sensitivity, stability, promptness etc.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12023A	Perform engineering measurements

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess fuel system operation	1.1. Fuel injection principles and component part functions/operation are understood. 1.2. Plant/equipment is started, operated and shut down to prescribed procedures. 1.3. Checks are undertaken safely and to prescribed procedures. 1.4. Flows, pressures and speeds are correctly determined and recorded. 1.5. Plant operating characteristics and parameters are understood. 1.6. Data is correctly interpreted regarding serviceability. 1.7. Faults are correctly interpreted regarding serviceability. 1.8. Governing characteristics and terminology are understood.

ELEMENT	PERFORMANCE CRITERIA
	1.9. Test equipment is used correctly.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- starting/operating and shutting down diesel plant/equipment
- conducting operational checks of the diesel fuel system
- determining and recording fuel flows, pressures and engine speed
- determining the serviceability of the fuel system from the test results and plant operating characteristics and parameters
- using test equipment
- undertaking calculations and numerical operations within the scope of this unit
- recording and reporting service activities

#### Required knowledge

Look for evidence that confirms knowledge of:

- the principles of fuel injection
- the function/operation of each component in a fuel injection system
- the procedures for starting up, operating and shutting down diesel plant and equipment
- the operational checks to be made on the diesel fuel system and procedures for carrying out checks
- the methods of determining flows, pressures and speeds and the tools, techniques and equipment to be used
- the procedures for carrying out and recording the above tests
- the plant operating characteristics and parameters
- the reasons for the decisions made with respect to serviceability

## REQUIRED SKILLS AND KNOWLEDGE

- likely faults and causes for unserviceable systems
- the principles of governing and the function of the governor on the given plant/equipment
- hazards and control measures associate with testing compression ignition fuel systems, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to test compression ignition fuel systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with testing compression ignition fuel systems, or other units requiring the exercise of the skills and knowledge covered by this unit.



**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Component**

Fuel system components include tank, filters, diesel injectors, fuel pumps and governing apparatus

**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18027C Overhaul engine fuel system components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers cleaning and assessing parts, recording and interpreting measurements, and reconditioning and setting up the equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit refers typically to the work undertaken on large stationary or mobile diesel engines and would entail the rebuilding/setting up of fuel pumps, governors, injectors and associate equipment.</p> <p>Fuel system types typically include port and helix, sleeve metering, unit injection, distributor and pressure/time.</p> <p>All work is undertaken to manufacturers' specifications and standard operating procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Clean and assess parts	<p>1.1.Components are disassembled according to manufacturers' recommendations.</p> <p>1.2.Specialised tools are used correctly.</p> <p>1.3.Parts are assessed visually for abnormal wear or defects.</p> <p>1.4.Characteristics of surface finishes and wear patterns associated with pumps/governors/injectors are understood.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.5.Appropriate cleaning method/solution and procedures are selected.</p> <p>1.6.Parts are correctly protected and stored ready for reassembly.</p> <p>1.7.Parts are made identifiable according to their original location in the pump/injector and protected and stored as required for reassembly.</p>
2. Record and interpret measurements	<p>2.1.Measurements are accurately obtained and recorded.</p> <p>2.2.Measurements and part condition is correctly interpreted when determining reuse/replacement.</p>
3. Recondition and set up equipment	<p>3.1.Fuel system and governing functions, characteristics, applications and terminology are understood.</p> <p>3.2.Components identified as faulty are reconditioned and replaced.</p> <p>3.3.Components are assembled according to manufacturers' specifications.</p> <p>3.4.Test equipment is used correctly.</p> <p>3.5.Components are tested and set to specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- dismantling the engine fuel system components
- using specialised tools and test equipment
- visually checking parts for abnormal wear or defects
- storing fuel system parts
- identifying parts according to their original location in the pump/injector
- identifying parts to be reused/replaced

## REQUIRED SKILLS AND KNOWLEDGE

- measuring fuel system components
- recording measurements
- obtaining specifications, parts lists, etc. of fuel system components
- replacing, reconditioning and assembling faulty components
- testing and setting to specification fuel system components
- undertaking calculations and numerical operations within the scope of this unit
- checking for conformance to specification

## Required knowledge

Look for evidence that confirms knowledge of:

- the sequence for disassembling engine fuel components
- specialised tools required and their application
- common defects, examples and causes of abnormal wear
- the characteristics of surface finishes and wear patterns for fuel system components
- the method of cleaning fuel system components
- the appropriate solvents for cleaning fuel systems
- the procedures for cleaning, protecting and storing fuel system components
- the procedures for marking fuel system components in readiness for reassembly
- the measuring instruments to be used to measure fuel system components and reasons for selecting the chosen measuring instruments
- the procedures for recording fuel system component measurements
- the principles of operation of diesel fuel systems
- the procedures for reconditioning and/or replacing faulty fuel system components
- the procedures for assembling and testing fuel system components
- the specifications of the fuel system components
- the tools, techniques and equipment required to carry out fuel system component tests
- the procedures for setting fuel system components
- hazards and control measures associate with overhauling engine fuel system components, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to overhaul engine fuel system components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with overhauling engine fuel system components, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Governors</b>	Governor types include mechanical, pneumatic, hydraulic and electronic

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18028B Maintain engine lubrication systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing lubrication system operations and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	Lubrication system testing would require the obtaining of flow, temperature and pressure measurements.  <b>Band: A</b> <b>Unit Weight: 2</b>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble

<b>Prerequisite units</b>		
		engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Assess lubrication system operation	<p>1.1.Relevant information is obtained and correctly interpreted prior to any testing.</p> <p>1.2.Checks are undertaken safely and to prescribed procedures.</p> <p>1.3.Flows, pressures and temperatures are correctly determined and recorded.</p> <p>1.4.Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.5.Lubricant fluid characteristics, terminology and applications are understood.</p> <p>1.6.Test equipment is used correctly.</p> <p>1.7.Results of spectrographic or laboratory analysis are correctly evaluated and recommendations are made regarding adjustments to future maintenance activities.</p> <p>1.8.Auxiliary lubrication systems are assessed for correct</p>

ELEMENT	PERFORMANCE CRITERIA
	operation.
2. Rectify faulty components	<p>2.1.Replacement components are correctly selected using manufacturers' data.</p> <p>2.2.Components are removed and refitted to engine by following prescribed procedures.</p> <p>2.3.Final adjustments are made that bring system in line with specifications.</p> <p>2.4.Test and rectification activities are accurately recorded.</p> <p>2.5.Engine is free of lubricant leaks after repair work is carried out.</p> <p>2.6.Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- checking the lubrication system
- determining and recording oil flows, pressures and temperatures
- identifying faulty components
- using test equipment
- obtaining/interpreting the results of lubricating oil tests
- checking auxiliary lubrication systems for correct operation where appropriate
- selecting replacement components
- removing, refitting and adjusting lubrication system components
- reporting and recording test and work activities

## REQUIRED SKILLS AND KNOWLEDGE

- checking lubrication system components for wear and clearance
- undertaking calculations and numerical operations within the scope of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- the operation of the lubrication system
- the procedures for testing/checking lubrication
- hazards and control measures associated with checking and rectifying lubrication systems, including housekeeping
- the tests to be undertaken and equipment and techniques to be used to determine oil flows, pressures and temperatures
- the procedures for recording lubrication system test results
- the specifications of the lubrication system components
- the appropriate corrective action for faulty components
- the characteristics of lubricants and application of a variety of lubricants
- the procedures and reasons for analysing lubricating oil samples
- the likely causes of a range of out of specification test results
- the appropriate corrective action to be taken
- the implications of out of specification test results on maintenance schedules and requirements
- the reasons for installing auxiliary lubrication systems on diesel plant and equipment
- the operation of the auxiliary lubrication system
- the procedures for removing/replacing lubrication system components
- the procedures for adjusting lubrication systems
- the procedures for recording test and repair activities
- the procedures for checking lubrication systems for leaks
- the measuring equipment/techniques used to determine lubrication system component wear and clearances
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to maintain engine lubrication systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining engine lubrication systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Faults</b>	Typical symptoms of faults would be lubrication pressures/temperatures that are too low/high; excessive or too little consumption/flow, etc.
<b>Test equipment</b>	Pressure/temperature and/or flow meters
<b>Adjustments</b>	May include setting of bypass/regulating/relief valves to specified pressures of flows

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18029B Tune diesel engines

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers compression testing and tuning up the engine.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to tune up procedures and evaluation of engine performance on compression ignition engines. The person performing these tasks should demonstrate an understanding of theory and be able to carry out procedures associated with servicing, adjusting and evaluating engine performance and be able to perform the following:</p> <ul style="list-style-type: none"><li>• remove injectors, install a compression gauge, carry out a compression test and interpret the test results</li><li>• carry out a machine stall test or engine load test to determine engine condition by measuring air inlet restriction, boost pressure, exhaust back pressure and crankcase pressure</li><li>• evaluate exhaust smoke and determine corrective action</li><li>• adjust engine valve clearances</li><li>• check and adjust injection pump timing on in-line pumps and rotary pumps using either spill, pin, mark or dial gauge methods; time and calibrate unit injectors</li><li>• adjust governor settings - maximum speed/idle speed</li><li>• test and adjust injectors</li><li>• be able to isolate injectors on a running engine to determine cylinder misfire.</li></ul> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18026C	Test compression ignition fuel systems
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Compression test engine	1.1.Injectors are removed and fuel system for each cylinder is isolated correctly. 1.2.Appropriate adaptors are selected and fitted. 1.3.Readings obtained are accurately recorded and interpreted. 1.4.Compression readings are corrected for adaptor used.
2. Perform tune up	2.1.If applicable, firing pressures are accurately determined and adjusted to specification. 2.2.Engine is started, operated, loaded, and shut down safely. 2.3.Test equipment is correctly applied. 2.4.Air restriction, boost, back pressure and flow tests are performed according to manufacturers' recommendations. 2.5.Readings are recorded and variances from specifications are correctly determined. 2.6.Density of exhaust smoke is correctly determined. 2.7.Valve clearance and/or timing is correctly adjusted. 2.8.Injection pump or injector timing is adjusted to specification. 2.9.Governor rack travel, torque spring load limit, overspeed trips, aneroid or fuel ratio control is adjusted to specification. 2.10. Injector opening pressure is correctly determined and adjusted.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

**REQUIRED SKILLS AND KNOWLEDGE**

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable documents
- planning and sequencing operations
- checking and clarifying task-related information
- removing injectors from each cylinder and isolating the fuel system
- fitting appropriate adaptors to the cylinders
- obtaining and recording compression readings and correcting readings for the adaptor used
- where appropriate, adjusting firing pressures
- starting, operating, loading and shutting down the engine safely in accordance with standard operating procedures
- using test equipment
- selecting and conducting appropriate tests
- recording test readings
- identifying variations from specifications of any test result
- determining the density of exhaust smoke
- adjusting valve clearance and/or timing
- adjusting injector pump or injector timing to specification
- adjusting the governor rack travel, torque spring load limit, overspeed trips, aneroid or fuel ratio control to specification
- adjusting the injector opening pressure to specification

**Required knowledge**

Look for evidence that confirms knowledge of:

- the procedures for removing injectors from cylinders and reasons for isolating the fuel system
- appropriate adaptors and reasons for using adaptors
- the procedures for fitting adaptors to the cylinders
- the procedures for compression testing diesel engines
- the procedures for recording compression readings
- the procedures for comparing the compression readings with specifications and identifying any deviations
- the likely causes of any detected deviations from specification
- the corrections required for compression readings to take account of the adaptor used
- the procedures for adjusting firing pressures
- the procedures for starting, operating, loading and shutting down diesel engines
- hazards and control measures associated with starting, operating, loading and shutting down diesel engines, including housekeeping
- the test equipment and procedures to be used in the tuning of diesel engines

**REQUIRED SKILLS AND KNOWLEDGE**

- the manufacturer's recommended tests and reasons for conducting the tests
- the procedures for recording test results
- the procedures, equipment and techniques for determining exhaust smoke density
- the procedures for adjusting valve clearances and/or timing
- the procedures for adjusting injector pump and injector timing
- the timing and pressures to be achieved
- the procedures for adjusting the governor rack travel, torque spring load limit, overspeed trips, aneroid or fuel ratio control
- the governor specifications
- the procedures for adjusting injector opening pressure
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to tune diesel engines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with tuning diesel engines, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	

**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18030B Diagnose and rectify low voltage electrical systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers using test instruments, testing the battery, and assessing and rectify wiring faults.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to testing and rectification activities associated with 12, 24 and 36 volt wiring systems on vehicles, plant and stationary equipment. The system extends to wiring, switching mechanisms and circuit protection devices.</p> <p>This unit should not be selected with any of the following Units: Unit MEM18045B (Fault find/repair electrical equipment/components up to 250 volts single phase supply), or Unit MEM18046B (Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c).</p> <p>Except in exceptional circumstances this unit should not be selected with Unit MEM18056B (Diagnose and repair analog equipment and components) or Unit MEM18066B (Diagnose and repair microprocessor based equipment).</p> <p>If soldering of wires/connections is required, see Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use test instruments	1.1. Electron theory, current, voltage and resistance



ELEMENT	PERFORMANCE CRITERIA
	<p>principles are understood.</p> <p>1.2.Appropriate test instruments are selected, used and maintained to determine current, voltage and resistance.</p> <p>1.3.Electrical drawings and manufacturers' diagrams are correctly interpreted.</p> <p>1.4.Series, parallel and series parallel circuits are correctly determined.</p> <p>1.5.Basic electrical laws are understood and correctly applied.</p> <p>1.6.AVR test instruments are correctly connected into circuits.</p> <p>1.7.Meters are read to standard accuracy; and wave form and quantities are determined using general purpose oscilloscope.</p> <p>1.8.Multipliers and shunts are correctly used and applied.</p>
2. Test battery	<p>2.1.Chemical battery operating principles are understood.</p> <p>2.2.Electrolyte level is correctly determined and specific gravity readings temperature is corrected.</p> <p>2.3.Dry charge preparation and recharging of batteries is carried out correctly.</p> <p>2.4.Discharge testing is performed according to prescribed procedures.</p> <p>2.5.Replacement batteries are correctly selected for application.</p>
3. Assess and rectify wiring faults	<p>3.1.Wiring faults are correctly isolated.</p> <p>3.2.Replacement cables/wires are correctly sized.</p> <p>3.3.Insulation quality is correctly determined.</p> <p>3.4.Wiring looms are correctly made up for application and securely fixed.</p> <p>3.5.Wiring terminations are stripped, fitted, prepared and made correctly.</p> <p>3.6.Corrosion is removed, neutralised and appropriate protective coating is applied.</p> <p>3.7.Relays, solenoids, contacts and circuits are correctly tested and repaired/replaced.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- selecting and using the correct test instrument for a variety of electrical circuits, to measure the current, voltage and resistance of specified circuit components or sections of circuitry
- applying Ohm's law to determine the required values of voltage, current and resistance for a range of electrical circuits
- determining the resistance of series and parallel circuits
- connecting electrical test instruments into given circuits to determine the required values of current, voltage and resistance
- connecting and adjusting a general purpose oscilloscope to a given electrical circuit to measure wave forms at nominated points in the circuit
- determining the specific gravity of the electrolyte for temperature variations
- preparing dry batteries for charging and recharging
- performing discharge testing of batteries
- testing given electrical circuits and, where appropriate, identifying wiring faults
- using supplier catalogues
- making up wiring looms
- terminating wiring
- removing and/or neutralising corrosion from terminals and connections, and applying appropriate protective coatings
- testing a range of circuit components for correct operation and identifying and repairing faulty circuit components

#### Required knowledge

Look for evidence that confirms knowledge of:

- the principles of electron theory
- definitions of current, voltage and resistance in terms of electrical circuits
- the relationships between current, voltage and resistance for a variety of given electrical circuits
- the instruments and procedures to be used to measure current, voltage and

**REQUIRED SKILLS AND KNOWLEDGE**

- resistance
- the procedures for maintaining electrical test equipment
- the function of a variety of electrical circuits identified from given electrical drawings/diagrams
- the symbols used in electrical drawings/diagrams
- the components of a variety of electrical circuits identified by given electrical drawings/diagrams
- the differences between series and parallel electrical circuits
- the function of a general purpose oscilloscope and procedures for connecting a general purpose oscilloscope into given electrical circuits
- the use of wave forms in the testing of electrical circuits
- the accuracy to which a range of electrical test equipment can be read
- the procedures for using multipliers and shunts in the measurement of electrical circuits
- the operation of a chemical battery
- the function of the electrolyte in batteries
- the procedures for measuring the specific gravity of the electrolyte
- the effect of temperature on the specific gravity of the electrolyte
- the procedures for preparing dry batteries for charging
- the procedures for recharging batteries
- hazards and control measures associated with charging/recharging of batteries and discharge testing, including housekeeping
- the purpose and procedures for discharge testing of batteries
- the specifications applied to batteries
- examples and causes of common faults in electrical wiring
- the test procedures for isolating wiring faults
- the specifications of cables and wires used in given electrical circuits
- the specification of the insulation materials
- the procedures for making up and fixing wiring looms can be given.
- the procedures for stripping, fitting and preparing wiring terminations
- the procedures for soft and hard soldering/crimping of wiring terminations
- the effect of corrosion on the performance of electrical circuits and connections
- the procedures for corrosion removal and/or neutralisation
- coatings available to stop/inhibit corrosion
- the correct operational relays, solenoids and contacts
- common faults and causes in relays, solenoids, contacts and circuits
- the procedures for testing circuit components
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to test and rectify low voltage electrical systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with testing and rectifying low voltage electrical systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Test instruments**

Multimeters, amp meters, circuit testers

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Maintenance and diagnostics



## MEM18031B Diagnose and rectify low voltage starting systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing starting motor operation, and testing and repairing starting motors.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers engine electrical starting systems and would require extensive use of AVR test equipment.</p> <p>If soldering of wires is required, see Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

Prerequisite units		
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18030B	Diagnose and repair low voltage electrical systems

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess starting motor operation	<p>1.1.Magnetism, induced voltage and electromagnetism and electric motor principles are understood.</p> <p>1.2.Starting motor component functions and multi-pole/winding/shunt wiring arrangements are understood.</p> <p>1.3.Cranking motor drive mechanism is correctly performance tested.</p> <p>1.4.Starter locked armature current, voltage and torque are correctly determined.</p>



ELEMENT	PERFORMANCE CRITERIA
2. Test and rectify starting motors	<p>2.1.Starting motors are dismantled and assembled according to manufacturers' recommendations.</p> <p>2.2.Testing is performed to determine shorts to ground, turn shorts, winding continuity, etc.</p> <p>2.3.Solenoid, relays and over-temperature devices are correctly tested.</p> <p>2.4.Starter engagement mechanism is tested and adjusted where possible i.e.: pinion clearance.</p> <p>2.5.Starting system is free of excessive voltage drops.</p> <p>2.6.Starting and charging circuit connections are correctly made, tightened and insulated.</p> <p>2.7.Starter locked armature current, voltage and torque are correctly determined.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- identifying the construction of electric motors
- testing the cranking motor drive mechanism
- using appropriate tools, techniques and equipment to dismantle and assemble given starting motors in accordance with manufacturers' recommendations/procedures
- checking given starting motors for electrical faults
- testing the solenoids, relays and over-temperature devices for given starting motors, for conformance to specification
- checking operation and conformance of the engagement mechanism for given starting motors
- checking the starting system of given starting motors for excessive voltage drops
- checking conformance of all circuit connections to specifications for given starting

**REQUIRED SKILLS AND KNOWLEDGE**

motors

- testing the repaired/overhauled starting motor to ensure that the locked armature current, voltage and torque conform to specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- the concepts of magnetism, electromagnetism and induced voltage
- the principles of operation of electric motors
- the components and functions of common starting motors
- the effect of multi-pole/winding/ shunt wiring arrangements on starting motor performance
- the tests and test procedures that can be used to check the performance of the cranking motor drive mechanism
- the hazards and control measures associated with testing the performance of cranking motor drive mechanisms, including housekeeping
- the concept of 'locked armature' in terms of current, voltage and torque
- the starter locked armature specifications
- the procedures, tools and equipment for determining locked armature current, voltage and torque
- the manufacturers' recommended dismantling/assembling procedures, tools and equipment for given starting motors
- the range of electrical tests that can be applied to starting motors and the purpose of these tests
- the equipment and procedures required to carry out the tests
- the function of solenoids, relays and over-temperature devices
- the procedures for testing solenoids, relays and over-temperature devices for correct operation
- the operational specifications of the solenoids, relays and over-temperature devices
- the procedures for testing and adjusting starter engagement mechanisms
- the specifications of the starter engagement mechanism
- the effect and causes of voltage drops on starting system operation/performance
- the procedures for checking starting systems for excessive voltage drops
- the effect of loose, poorly joined and/or inappropriate insulation on starting motor performance/operation
- the specifications of all circuit connections
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to test and rectify low voltage starting systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with testing and rectifying low voltage starting systems or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Starting motor**

Axial and coaxial type starters with drive arrangements such as Dyer, Positork, Sprag clutch, overrunning clutch and inertia drive

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18032B Maintain induction/exhaust systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing induction/exhaust system operation and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>Testing procedures would typically require the person to understand the operation of the apparatus installed to balance fuel injection to boost pressure; and control devices installed to prevent excessive turbocharger RPM and/or boost pressure. Typical faults would be associated with excessive air inlet restrictions, excessive exhaust back pressures, too much/little boost pressure, ineffective inter/after cooling, etc.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements

Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess induction/exhaust system operation	<p>1.1. Supercharging, filtering, inter/after cooling principles, terminology and applications are understood.</p> <p>1.2. Relevant information is obtained and correctly interpreted prior to any testing.</p> <p>1.3. Checks are undertaken safely and to prescribed procedures.</p> <p>1.4. Flows, pressures and temperatures are correctly determined and recorded.</p> <p>1.5. Faults are correctly isolated to component level and</p>

ELEMENT	PERFORMANCE CRITERIA
	appropriate corrective action is determined. 1.6. Test instruments and equipment are used correctly.
2. Rectify faulty components	2.1. Component wear and clearances are correctly determined using manufacturers' recommendations. 2.2. Replacement components are correctly selected using manufacturers' data. 2.3. Components are removed and refitted to engine following prescribed procedures. 2.4. Test and rectification activities are accurately recorded. 2.5. Engine is free of air/exhaust leaks after repair work is carried out.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- identifying a variety of applications of supercharging, filtering inter and after cooling
- checking the induction/exhaust system for correct operation in accordance with standard operating procedures
- determining the flows, pressures and temperatures of the given induction/exhaust system using appropriate techniques and equipment
- isolating faulty component in accordance with standard operating procedures
- using all test instruments and equipment
- visually and dimensionally checking component parts for wear
- using supplier catalogues to select component parts
- removing components and fitting to engines



**REQUIRED SKILLS AND KNOWLEDGE**

- recording all test and, where appropriate, repair activities
- checking the induction/exhaust system for leaks
- undertaking calculations and numerical operations within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles and terminology of supercharging, filtering, inter and after cooling
- the performance and operational specifications of the induction/exhaust system
- the procedures and safety precautions for testing induction/exhaust systems for correct operation
- the equipment and procedures necessary to test flows, pressures and temperatures associated with induction/exhaust systems
- the procedures for recording flows, pressures and temperatures
- common faults associated with induction/exhaust systems and causes of those faults
- the appropriate action and procedures for correcting common faults in induction/exhaust systems
- the component specifications/tolerances and actions to be taken if the components are outside of specification
- the action to be taken if the components are 'just' within specification
- the measuring instruments to be used to carry out dimensional checks on components
- the procedures and safety precautions for removing/fitting components to engines
- the procedures for recording test and repair activities undertaken on induction/exhaust systems
- the consequences of air/exhaust leaks on the safe operation of the induction/exhaust system and procedures for testing for leaks in induction/exhaust systems
- hazards and control measures associate with maintaining and rectifying induction/exhaust systems, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to maintain and rectify induction/exhaust systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining and rectifying induction/exhaust systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Supercharging</b>	Supercharging apparatus includes turbo charging equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18033B Perform engine bottom-end overhaul

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers dismantling, cleaning and assessing parts, recording and interpreting measurements, and reconditioning components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit refers to work typically undertaken in a bottom-end engine overhaul.</p> <p>It includes cylinder honing using hand held power tools, and replacement of bearings, piston rings and similar activities but not major machining such as crankshaft grinding, cylinder boring and tunnel boring.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements

Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Dismantle, clean and assess parts	<p>1.1.Characteristics of surface finishes and wear patterns associated with crankshaft and piston assemblies are understood and parts are correctly assessed for reuse or replacement.</p> <p>1.2.Engine is removed from plant, top-end components are removed and block assembly is dismantled according to manufacturers' recommendations.</p> <p>1.3.Parts are assessed for abnormal wear or defects.</p> <p>1.4.Appropriate cleaning solution and procedure is selected.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.5.Parts are racked or set out according to their original location in the engine.</p> <p>1.6.Characteristics of surface finishes and wear patterns associated with crankshaft and piston assemblies are understood and parts are correctly assessed for reuse or replacement.</p>
2. Record and interpret measurements	<p>2.1.Measurements are accurately obtained and recorded.</p> <p>2.2.Readings are correctly interpreted regarding replacement or reuse and appropriate under/oversize of replacement parts is determined.</p>
3. Recondition components	<p>3.1.Ridges, gaps, tapers, ovality and protrusions are identified and necessary corrective action is taken.</p> <p>3.2.Tools and equipment are correctly used.</p> <p>3.3.Components are assembled according to manufacturers' specifications.</p> <p>3.4.Bearing clearances are correctly determined by calculation or direct measurement.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- removing the engine and top-end components
- removing ridges, gaps, tapers, protrusions and ovality
- dismantling block assembly
- calculating bearing clearances
- checking parts for abnormal wear or defects
- identifying components for reuse or replacement

**REQUIRED SKILLS AND KNOWLEDGE**

- cleaning parts using appropriate solutions and procedures
- racking and setting out engine parts according to their original position in readiness for reassembly
- obtaining and recording measurements
- identifying replacement parts required as being under or over size
- using tools and equipment
- assembling engine bottom-end components
- undertaking calculations and numerical operations within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- the characteristics of surface finishes and wear patterns as applied to crankshaft and piston assemblies
- the specifications of crankshaft and piston assemblies
- the reasons for identifying the components for reuse or replacement
- the procedures for dismantling the block assembly and removing the engine from the plant
- the procedures for removing the top end from the engine
- the tools, techniques and equipment to be used
- the reasons for selecting the chosen tools, techniques and equipment
- the hazards and control measures associated with the removal of engines/engine components, including housekeeping
- the action to be taken when abnormal wear or defects are observed in the engine components
- the procedures and solution for cleaning engine parts
- the procedures for racking and/or setting out of parts in readiness for reassembly
- the measuring instruments to be used to measure engine components
- the procedures for recording engine measurements
- the concept of under/over size of replacement parts and the reasons for identifying replacement parts as under or over size
- the procedures for removing ridges, gaps, tapers, ovality and protrusions
- the tools, techniques and equipment required to correct the above faults
- the procedures for assembling engine bottom ends
- the precautions to be taken when assembling engine bottom ends
- the methods and procedures for determining bearing clearances
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform engine bottom-end overhaul. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing engine bottom-end overhaul or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18034B Perform engine top-end overhaul

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers dismantling, cleaning and assessing parts, recording and interpreting measurements, and reconditioning the cylinder head.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers top-end overhaul of all types of engines and work associated with the reconditioning of cylinder heads including determining the causes of failures, replacement of inserts, guides and injector sleeves, grinding of valves and seats, and crack/twist/bend testing etc. It includes both the reconditioning of original parts, crack repairs using non-welding techniques and sizing and fitting of replacement parts.</p> <p>Where diagnostic skills are not required and where straightforward removal and replacement of pre-manufactured bearings is undertaken, Unit MEM18055B (Dismantle, replace and assemble engineering components) should be regarded as sufficient.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Dismantle clean and	1.1.Characteristics of surface finishes and wear patterns

ELEMENT	PERFORMANCE CRITERIA
assess parts	<p>associated with valve operating mechanisms and cylinder head are understood.</p> <p>1.2.Cylinder head and ancillary components are disassembled according to manufacturers' recommendations.</p> <p>1.3.Parts are assessed for abnormal wear or defects.</p> <p>1.4.Appropriate cleaning solution/procedure is selected.</p> <p>1.5.Parts are correctly cleaned and stored ready for reassembly.</p> <p>1.6.Parts are racked or set out according to their original location in the engine.</p>
2. Record and interpret measurements	<p>2.1.Measurements are accurately obtained and recorded using appropriate measuring equipment.</p> <p>2.2.Parts are replaced or reused, and appropriate under/over size of replacement parts is determined.</p>
3. Recondition cylinder head	<p>3.1.Cylinder head is correctly pressure tested for serviceability.</p> <p>3.2.Spring tensions, valve and guide dimensions and surface flatness are measured and recorded.</p> <p>3.3.Cylinder head is removed according to manufacturers' specification.</p> <p>3.4.Grinding and cleaning equipment is correctly used.</p> <p>3.5.Operational parameters of cylinder head components are understood and applied in determining whether components are reconditioned or replaced.</p> <p>3.6.Injectors sleeves, sealing washers, plugs, capping etc. are replaced correctly.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other

## REQUIRED SKILLS AND KNOWLEDGE

- applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- removing the cylinder head from the engine
- dismantling the cylinder head and ancillary components
- identifying the cylinder head as serviceable or requiring repair/replacement
- pressure testing the cylinder head
- measuring and recording spring tension, valve and guide dimensions and surface flatness
- grinding valves and valve
- cleaning cylinder head and ancillary equipment using appropriate solutions
- identifying cylinder head components for repair or replacement
- replacing cylinder head components
- checking parts for abnormal wear or defects
- identifying components for reuse or replacement
- cleaning parts using appropriate solutions and procedures
- racking and setting out engine parts according to their original position in readiness for reassembly
- obtaining and recording measurements
- undertaking calculations and numerical operations within the scope of this unit

## Required knowledge

Look for evidence that confirms knowledge of:

- the characteristics of surface finishes and wear patterns as applied to valve operating mechanisms and cylinder heads
- the specifications of valve operating mechanisms and cylinder heads
- the procedures, tools, techniques and equipment for dismantling cylinder heads and ancillary equipment
- the hazards and control measures associated with the removal of cylinder heads and ancillary equipment, including housekeeping
- the procedures for storing parts in readiness for reassembly
- the procedures, tools, techniques and equipment for pressure testing cylinder heads
- the cylinder head specifications
- the procedures, tools, techniques and equipment for measuring spring tension, valve and guide dimensions and surface flatness
- the procedures for recording cylinder head and valve mechanism measurements
- the procedures, tools, techniques and equipment for removing the cylinder head from the engine
- the procedures, tools, techniques and equipment for grinding valves and valve seats
- the procedures and solutions for cleaning cylinder heads and ancillary equipment

**REQUIRED SKILLS AND KNOWLEDGE**

- the operational parameters of cylinder head components
- the procedures, tools, techniques and equipment for reassembling cylinder heads and their components
- the precautions to be taken when reassembling cylinder heads
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform engine top-end overhaul. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing engine top-end overhaul, or other units requiring the exercise of the skills and knowledge covered by this unit.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18035B Diagnose and rectify braking systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking and assessing braking systems, and replacing/repairing/overhauling braking system components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers braking systems associated with mobile equipment including mechanical, hydraulic, air and electrically operated types.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

<b>Prerequisite units</b>		
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check and assess braking system	1.1.Friction and heat principles, braking system types, arrangements, components including anti-lock systems, functions, and applications are understood. 1.2.Braking system is assessed for compliance with ADR regulations of appropriate standard. 1.3.Serviceability of friction materials is correctly assessed. 1.4.Braking system control devices are assessed for compliance with specifications. 1.5.Minimum operating dimensions are measured, recorded and corrective action is determined. 1.6.Faults are correctly diagnosed to component level and appropriate corrective action is determined.
2. Rectify and overhaul	2.1.Characteristics of surface finishes and wear patterns

ELEMENT	PERFORMANCE CRITERIA
braking system components	<p>associated with braking components are understood and measurements and part condition are correctly interpreted when determining reuse/replacement.</p> <p>2.2.Braking system components are removed, disassembled and handled correctly.</p> <p>2.3.Components are cleaned using appropriate fluid and procedure.</p> <p>2.4.Friction material to reaction member clearance is adjusted to specification.</p> <p>2.5.Tooling and equipment are correctly applied.</p> <p>2.6.Hydraulic/air/vacuum system is free of leaks/restrictions after repair work.</p> <p>2.7.All levers, linkages and pedal clearances are adjusted to specifications.</p> <p>2.8.Braking system is recommissioned and tested according to manufacturers' recommendations or appropriate standard/regulation.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- checking the braking system for compliance with ADR regulations
- checking friction materials and identifying as being serviceable or to be replaced
- measuring and recording brake operating dimensions
- identifying variation of brake operating measurement from specification
- checking the operation of the braking system for conformance to specification
- identifying faulty braking system components

**REQUIRED SKILLS AND KNOWLEDGE**

- identifying given components for reuse/replacement
- removing, dismantling and handling braking system components
- cleaning braking system components using appropriate solutions
- adjusting brake clearance
- using tools and equipment
- adjusting levers, linkages and pedal clearances
- testing the braking system for conformance with specifications/regulations
- recommissioning the braking system
- undertaking calculations and numerical operations within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles of friction and heat as applied to braking systems
- the function of the components of a variety of braking system types and arrangements
- typical applications of different types of braking systems
- the requirements of the relevant Australian Design Rule applying to brakes
- the procedures for checking braking systems for compliance with ADR regulations
- examples of worn and defective friction materials identified from given samples
- the specifications of the braking system
- the procedures, tools, techniques and equipment for measuring brake operating dimensions
- the procedures for recording brake operating dimensions
- the corrective action to be taken when brake operating measurement varies from specification
- the corrective action to be taken when faulty braking system components are identified
- the procedures for checking braking system operation
- the characteristics of surface finishes and wear patterns as applied to braking system components
- the specifications of the braking system
- the reasons for identifying the components for reuse or replacement
- the procedures, tools, techniques and equipment for removing and dismantling braking system components
- the precautions to be taken when handling braking systems components
- the reasons for selecting the chosen tools, techniques and equipment
- the procedures and solutions for cleaning braking system components
- the procedure for adjusting brake clearances
- the procedures for checking for hydraulic, air and vacuum system leaks and restrictions
- the procedures for adjusting levers, linkages and pedal clearances

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures for recommissioning the braking system
- the procedures for testing braking systems
- the tests to be carried out on the braking system
- the tools, techniques and equipment required to test the braking system
- the reasons for selecting the chosen tools, techniques and equipment
- hazards and control measures associate with testing and rectifying braking systems, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and repair braking systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and rectifying braking systems, or other

<b>EVIDENCE GUIDE</b>	
	units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Braking system</b>	Arrangements may include air, hydraulic, mechanical, electric, disc, operated wet disc drum, wheel/track brakes; anti-locking braking systems; transmission brakes and service; park and emergency brakes

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18037B Diagnose and rectify low voltage charging systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing generator/alternator operation, and testing and repairing and/or replacing generators and alternators.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to a wide variety of generators/alternators and both electro-mechanical and specialist electronic regulating apparatus, and the testing and rectification work associated with 12, 14, and 36 volt charging systems on vehicles, plant and stationary equipment.</p> <p>All work is carried out to legislative and regulatory requirements.</p> <p>If specialist electronic skills are required, appropriate competency units should be selected.</p> <p>This unit should not be selected with any of the following units: MEM18045B (Fault find/repair electrical equipment/components up to 250 volt single phase supply) or Unit MEM18046B (Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.).</p> <p>If soldering of wires is required, see Unit MEM05001B (Perform manual soldering/desoldering - electrical/electronic components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18030B	Diagnose and rectify low voltage electrical systems
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess generator/alternator operation	1.1.Magnetism, induced voltage and electromagnetism principles are understood. 1.2.Alternating and direct current generating principles, voltage/current regulation methods, and diode/condenser types and action are understood. 1.3.Charging system performance is checked and variances from system specifications are accurately recorded.
2. Test and rectify generators/alternators	2.1.Generators/alternators are dismantled and assembled correctly. 2.2.Charging faults are determined to component level. 2.3.Testing is performed to determine shorts to ground, turn shorts and winding continuity etc. 2.4.Alternator/generator is tested for normal and maximum output. 2.5.Voltage and/or current regulators and cut-outs and relays are correctly tested and adjusted to specification. 2.6.Condition of power/exciter diodes is correctly determined. 2.7.All faulty components are replaced according to manufacturers' recommendations i.e.: brush gear, bearings, diodes, contacts, relays, etc. 2.8.Charging system is free of excessive voltage drops and connections are correctly soldered, tightened and insulated.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other

**REQUIRED SKILLS AND KNOWLEDGE**

- applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- testing the charging system for correct operation
- recording variations from system specifications
- dismantling and reassembling given generators/alternators
- identifying charging faults in given generator/alternator systems
- conducting short circuit and winding continuity tests
- testing the given alternator/generator output for conformance to specification
- testing given voltage and current regulators, cut-outs and relays for correct operation and conformance to specifications
- determining the condition of given power/exciter diodes
- replacing faulty components
- checking the given generator/alternator charging system for excessive voltage drops
- undertaking calculations and numerical operations within the scope of this unit
- recording and reporting service activities

**Required knowledge**

Look for evidence that confirms knowledge of:

- the concepts of magnetism, electromagnetism and induced voltage
- the construction of generators
- the principles of operation of generators and alternators
- the methods of generating alternating and direct current for low voltage systems
- the methods of regulating voltage and current generated
- the function of diode and condenser types of regulator
- the tests that can be used to check the performance of the charging system
- the test procedures
- the hazards associated with testing the performance of the charging system, including housekeeping
- the charging system specifications
- the test equipment to be used in checking low voltage charging systems
- the procedures for recording charging system performance/variations from specifications
- the procedures for dismantling and reassembling generators/alternators
- the tools and equipment to be used in dismantling and reassembling generators/alternators
- the safety precautions and work procedures to be followed when working with generators/alternators
- the procedures and test equipment for identifying charging faults

**REQUIRED SKILLS AND KNOWLEDGE**

- the procedures and test equipment for testing short circuits and winding continuity
- the specifications of generator/alternator output
- the test equipment and procedures to be used to determine alternator/generator output
- the procedures for testing voltage and current regulators, cut-outs and relays
- the methods of adjusting voltage and current regulators, cut-outs and relays
- the operational specifications of voltage and current regulators, cut-outs and relays
- the test equipment to be used to check the operation of voltage and current regulators, cut-outs and relays
- the procedures for testing diodes and the test equipment to be used
- the precautions to be taken when testing diodes
- the components of generators/alternators that can be replaced
- the specifications of the faulty generator/alternator components
- the effect and causes of voltage drops on charging system operation/ performance
- the procedures for checking charging systems for excessive voltage drops
- the effect of loose, poorly soldered and/or inappropriate insulation on charging system operation
- the specifications of all circuit connections
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and rectify low voltage charging systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and rectifying low voltage charging systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18038B Maintain wheels and tyres

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing wheel condition, and repairing/replacing and maintaining the wheel.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the basic maintenance and repair or replacement of wheel rims and to the full range of wheel/tyre assemblies, plant and equipment using appropriate regulations, codes of practice, manufacturers' specifications or in-house standards as a guide for assessment repair and assembly.</p> <p>For complex rim repairs, appropriate fitting or welding units may be required, for example, Unit MEM18003C (Use tools for precision work) and Unit MEM18006C (Repair and fit engineering components).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools



<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Assess wheel condition	1.1.Rim/tyre designs, constructions, codes, balancing, fastening principles and terminology are understood. 1.2.Fastening components are correctly assessed for damage and security. 1.3.Abnormal tyre wear is recognised and cause of fault is correctly determined. 1.4.Unsafe tyre and/or wheel condition is recognised and remedial action is determined.
2. Rectify and maintain wheel	2.1.Safety procedures associated with tyre/wheel removal, handling, inflation, assembly and disassembly and fastening are understood and adhered to. 2.2.Wheels/tyres are safely removed and replaced using standard procedures and appropriate tools/equipment. 2.3.Tools and equipment are correctly applied and used.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.4. Ballasting and/or inflation of tyres is performed safely and to specification.</p> <p>2.5. Static/dynamic balancing of wheels is performed to specification.</p> <p>2.6. Rim/tyre/tube faults are rectified to specifications, regulations or codes.</p> <p>2.7. Rectification activities are accurately recorded.</p> <p>2.8. Wheel bearings are correctly lubricated to specification.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- identifying damaged fastening components
- identifying abnormal tyre wear
- checking wheel fastening components for damage and security
- identifying corrective action to be taken for unsafe tyre and wheel condition
- removing and replacing wheels/tyres using appropriate tools and equipment
- using tools and equipment correctly and appropriately
- undertaking ballasting and/or inflation of tyres
- balancing wheels to specification
- identifying repairable rim, tyre and tube faults
- repairing faults in rims/tyres/tubes to specification
- recording work activities
- lubricating wheel bearings in accordance with specification

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- the design and construction of a variety of rims and tyres
- the principles of fastening and balancing of wheels
- the relevant codes and standards
- the procedures for checking wheels for secure fastening
- the reasons for checking fastening components for damage and security
- the causes of abnormal tyre wear
- examples and causes of unsafe tyre and wheel condition
- the procedures for removing, handling, inflating, assembling/disassembling and fastening of tyres and wheels
- the safety precautions to be taken when working with wheels and tyres
- the tools, techniques and equipment required to carry out the above procedures
- the procedures, tools, techniques and equipment for static and dynamic balancing of wheels
- the reasons for selecting the chosen tools, techniques and equipment
- the procedures, tools, techniques and equipment for repairing rim, tyre and tube faults
- examples of unrepairable rim, tyre and tube faults
- the procedures for recording repairs undertaken on rims, tyres and tubes
- the procedures for lubricating wheel bearings
- types of wheel bearing lubricant and their application
- hazards and control measures associate with maintaining and rectifying wheels and tyres, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain wheels and tyres. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining wheels and tyres, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18039B Diagnose and rectify track type undercarriage

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing, repairing or replacing, and maintaining track assemblies.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit also refers to mobile plant equipment that uses crawler belts and/or chain links.</p> <p>It mainly applies to work conducted in the field.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

<b>Prerequisite units</b>		
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess track assembly	1.1.Track type undercarriage operating principles and terminology are understood. 1.2.Links, pins, sprockets, idlers, rollers, pads, etc. are assessed for wear/damage/reuse/replacement; and corrective action is determined. 1.3.Track frame alignment is checked and variances from specifications correctly are determined.
2. Rectify and maintain track assemblies	2.1.Safety procedures associated with removal and replacement of track undercarriage components are followed. 2.2.Track tension is correctly set to specification. 2.3.Clearances are adjusted to specification.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- checking track type undercarriage components for wear and damage using appropriate tools
- identifying worn or damaged components for repair or replacement
- checking the track frame for alignment
- identifying variations from alignment specifications
- removing and replacing track undercarriage components
- setting track tension to specification
- adjusting clearances to specification
- undertaking calculations and numerical operations within the scope of this unit
- recording and reporting service activities

#### Required knowledge

Look for evidence that confirms knowledge of:

- the operating principles of track type undercarriage
- the procedures, tools, techniques and equipment for checking track type undercarriage components for wear
- the reasons for selecting the chosen tools, techniques and equipment
- the specifications of the track type undercarriage components
- the action to be taken to overcome the wear and/or damage detected
- the procedures, tools, techniques and equipment for aligning track frames
- the procedures for removing and replacing track type undercarriage components
- the precautions to be taken when removing and replacing track type undercarriage components
- the procedures for setting track tension
- the procedures for adjusting clearances
- hazards and control measures associate with testing and rectifying track type

**REQUIRED SKILLS AND KNOWLEDGE**

- undercarriage, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and rectify track type undercarriage. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and rectifying track type undercarriage, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18040B Maintain suspension systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing, maintaining and repairing/replacing suspension systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to maintenance and repair/replacement activities associated with suspension systems of all types of wheeled and/or tracked plant/vehicles.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

<b>Prerequisite units</b>		
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess suspension systems	1.1.Steering geometry, alignment and suspension systems operation and terminology are understood. 1.2.Components are assessed for security, wear and faults and corrective action is determined. 1.3.Spring arrangements, control arms/links, dampening and control devices are tested for correct operation. 1.4.Axle alignment/tracking is assessed and variance from specification is determined. 1.5.Auto/manual levelling devices performance is tested.
2. Maintain suspension systems	2.1.Axles are aligned to specification. 2.2.Ride height is adjusted to specification. 2.3.Suspension system is re-gassed to specification. 2.4.Suspension components are safely removed and replaced according to standard procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking the suspension components for wear, faults and security
- testing spring arrangements, control arms/links and dampening devices for correct operation
- checking axle alignment/tracking for conformance to specification
- identifying variances of axle alignment from specification
- testing automatic/manual levelling devices for correct operation
- aligning axles to specification
- adjusting the ride height to specification
- re-gassing the suspension system to specification
- removing and replacing suspension components
- undertaking calculations and numerical operations within the scope of this unit
- recording and reporting service activities

#### Required knowledge

Look for evidence that confirms knowledge of:

- the operation of suspension systems and the effects of steering geometry and alignment
- the procedures, tools, techniques and equipment for checking suspension system components for wear, faults, security and conformance to specification
- the action to be taken to correct non-conformance to specification
- the procedures for aligning axles
- the axle alignment specifications
- the tools, techniques and equipment required to maintain and repair suspension systems
- the reasons for selecting the chosen tools, techniques and equipment
- the procedures for adjusting ride height

**REQUIRED SKILLS AND KNOWLEDGE**

- the ride height specifications
- the procedures to be followed in re-gassing suspension systems
- the precautions to be taken when re-gassing suspension systems
- the procedures for the removal and replacement of suspension systems
- the precautions to be taken when removing/replacing suspension systems
- hazards and control measures associate with maintaining and rectifying suspension systems, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain suspension systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining suspension systems or other units



<b>EVIDENCE GUIDE</b>	
	requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	

**RANGE STATEMENT**

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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18041B Maintain steering systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing steering system operation, and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit covers a number of steering systems for vehicles, mobile plant and equipment - manual, hydraulically assisted, full hydraulic, articulated and track type systems such as hydrostatic, clutch and differential steering systems.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held

<b>Prerequisite units</b>		
		operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess steering system operation	<p>1.1.Relevant information is obtained and correctly interpreted prior to any testing.</p> <p>1.2.Performance tests are undertaken on primary and/or emergency steering systems safely and to prescribed procedures.</p> <p>1.3.Flows, pressures, alignment angles are correctly determined and recorded.</p> <p>1.4.Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.5.Power assisted steering component functions, wheel/axle alignment principles, terminology and applications are understood.</p> <p>1.6.Test equipment is used correctly.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Repair/replace faulty components	<p>2.1. Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p> <p>2.2. Replacement components are correctly selected using manufacturers' data.</p> <p>2.3. Components are removed and refitted following prescribed procedures.</p> <p>2.4. Alignment adjustments are made that bring wheel/axles in line with specifications.</p> <p>2.5. Test and rectification activities are accurately recorded.</p> <p>2.6. Adjustments are made to primary and/or emergency steering systems that bring system in line with specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- testing steering system for correct performance
- recording all test results and measurements
- using all test equipment correctly and appropriately
- measuring steering system components using appropriate tools, techniques and equipment
- removing and refitting steering system components
- selecting replacement components using manufacturers' data
- aligning wheels and axles to specification
- undertaking calculations and numerical operations within the scope of this unit

**REQUIRED SKILLS AND KNOWLEDGE**

- recording test and rectification activities
- adjusting the steering system in accordance with specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- operation of the steering system and its components
- procedures for testing steering system performance and tests to be undertaken
- the tools, techniques and equipment necessary to maintain and rectify steering systems
- the reasons for selecting the chosen tools, techniques and equipment
- the precautions to be taken when testing steering systems
- procedures for recording test results
- identification of faulty components and corrective action to be taken
- the reasons for selecting the chosen corrective action
- the operation of power assisted steering systems
- the effects of wheel/axle alignment on steering system operation
- measuring equipment to be used
- the procedures for checking components for wear and clearance
- the procedures and precautions for removing and refitting steering system components
- the procedures for aligning wheels and axles
- the procedures for recording test and rectification activities
- the procedures for adjusting primary and emergency steering systems
- the effect of adjustments on the steering system specifications
- safe work practices and procedures
- hazard and control measures associated with maintaining and rectifying steering systems, including housekeeping

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain steering systems. Competency in this unit cannot be claimed until all prerequisites have been

<b>EVIDENCE GUIDE</b>	
	satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining steering systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Steering system</b>	Manual, hydraulically assisted, full hydraulic, articulated and track type systems such as hydrostatic, clutch and differential steering systems for vehicles, mobile plant and equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18042C Diagnose and rectify manual transmissions

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing clutch and transmission operation, and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to diagnosis and repair activities associated with single/multi plate type, clutch assemblies, counter shaft transmissions, power take-offs and transfer cases.</p> <p>Testing and assessment of performance would typically require operation of the plant or equipment.</p> <p>If hydraulic clutch assembly is used, then competency Unit MEM18018C (Maintain pneumatic system components) may need to be accessed.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess clutch/transmission operation	<p>1.1.Clutch and release mechanism types and principles of operation are understood.</p> <p>1.2.Power flows, gear types and ratios, torque multiplication, synchronising and shifting principles are understood.</p> <p>1.3.Relevant information is obtained and correctly interpreted prior to any testing.</p> <p>1.4.Preliminary checks are undertaken safely and to</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>prescribed procedures.</p> <p>1.5.Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.6.Test equipment is adapted and used correctly.</p> <p>1.7.Component parts are correctly assessed for reuse or replacement.</p>
2. Repair/replace faulty components	<p>2.1.Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p> <p>2.2.Replacement components are correctly selected using manufacturers' data.</p> <p>2.3.Components are removed and refitted to clutch/transmission assembly following prescribed procedures.</p> <p>2.4.Adjustments are made correctly using appropriate tooling/equipment and manufacturers' data.</p> <p>2.5.Test and rectification activities are accurately recorded.</p> <p>2.6.Clutch/transmission assembly is free of excessive noise and operates to specification after work is carried out.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- identifying faulty clutch and/or transmission components
- checking task-related information
- checking for conformance to specification
- checking the clutch and transmission for correct operation

**REQUIRED SKILLS AND KNOWLEDGE**

- using test equipment correctly
- testing the clutch/transmission components for conformance to specification
- identifying component parts for reuse or replacement
- removing and refitting components to clutch/transmission assemblies
- adjusting clutch and transmission components using appropriate tools, techniques and equipment
- recording test and rectification activities
- identifying replacement components using manufacturers' data
- operating the clutch/transmission assembly free of excessive noise and in conformance to specifications
- undertaking calculations and numerical operations within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles of operation of a variety of clutches
- the functions of the components of a variety of clutches
- the principles of operation of manual transmissions
- the concepts of gear ratios, torque multiplication and synchronisation
- the procedures for checking clutches and transmissions for correct operation
- the appropriate action to correct the faulty component(s)
- the test equipment to be used in checking/testing clutches and transmissions for correct operation
- the reasons for selecting the chosen test equipment
- the procedures for testing clutches and transmissions, including any necessary adaptation of test equipment
- the procedures for checking clutch and transmission components for wear and clearance
- the tools, techniques and equipment to be used to determine component wear and clearance
- procedures for removing and refitting clutch and transmission components
- the procedures for adjusting clutch and transmission components
- the tools, techniques and equipment to be used to maintain and repair clutch and transmission assemblies
- the effects of the adjustments on clutch and transmission operation
- the procedures for recording test and repair activities
- the clutch/transmission assembly specifications
- hazards and control measures associated with testing and rectifying manual transmissions, including housekeeping
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to diagnose and rectify manual transmissions. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and rectifying manual transmissions or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures,

<b>EVIDENCE GUIDE</b>	
	product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18043C Diagnose and rectify automatic transmissions

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing converter/transmission operation, and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to testing and repair or replacement activities associated with automatic, semi automatic and hydrostatic transmissions, and fluid coupling/torque converter assemblies. Control of lockup/shifting etc. can be either fully hydraulic or electronic. Testing and assessment of performance would typically require operation of the plant or equipment.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements



Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess converter/transmission operation	<p>1.1.Torque converter, simple and compound planetary gearing, and hydraulic control operating principles are understood.</p> <p>1.2.Relevant information is obtained and is correctly interpreted prior to any testing.</p> <p>1.3.Preliminary checks are undertaken safely and to prescribed procedures.</p> <p>1.4.Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.5.Test equipment is adapted and used correctly.</p>

ELEMENT	PERFORMANCE CRITERIA
	1.6.Component parts are correctly assessed for reuse or replacement.
2. Repair/replace faulty components	<p>2.1.Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p> <p>2.2.Replacement components are correctly selected using manufacturers' data.</p> <p>2.3.Components are removed and refitted to converter/transmission assembly following prescribed procedures.</p> <p>2.4.Adjustments are made correctly using appropriate tooling/equipment and manufacturers' data.</p> <p>2.5.Test and rectification activities are accurately recorded.</p> <p>2.6.Converter/transmission assembly is free of excessive noise and operates to specification after repair work is carried out.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- identifying faulty automatic transmission components
- checking the automatic transmission for correct operation
- using test equipment correctly
- testing the transmission components for conformance to specification
- identifying component parts for reuse or replacement
- removing and refitting components to the automatic transmission assembly

**REQUIRED SKILLS AND KNOWLEDGE**

- adjusting automatic transmission components using appropriate tools, techniques and equipment
- recording test and rectification activities
- identifying replacement components using manufacturers' data
- operating the automatic transmission assembly free of excessive noise and in conformance to specifications
- undertaking calculations and numerical operations within the scope of this unit

**Required knowledge**

Look for evidence that confirms knowledge of:

- the principles of operation of automatic transmissions
- the function of torque converters, planetary gearing and hydraulic controls in automatic transmissions
- the procedures for checking automatic transmissions for correct operation
- the appropriate action to correct the faulty component(s)
- the test equipment to be used in checking/testing automatic transmissions for correct operation
- the reasons for selecting the chosen test equipment
- the procedures for testing automatic transmissions, including any necessary adaptation of test equipment
- the procedures for checking automatic transmission components for wear and clearance
- the tools, techniques and equipment to be used to determine component wear and clearance
- the reasons for selecting the chosen tools, techniques and equipment
- the procedures for removing and refitting automatic transmission components
- the procedures for adjusting automatic transmission components
- the tools, techniques and equipment to be used to maintain and repair automatic transmission assemblies
- the effects of the adjustments on automatic transmission operation
- the procedures for recording test and rectification activities
- the automatic transmission assembly specifications
- hazards and control measures associate with testing and rectifying automatic transmissions, including housekeeping
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to diagnose and rectify automatic transmissions. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and rectifying automatic transmissions, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for  
assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance&diagnostics
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## MEM18044C Diagnose and rectify drive line and final drives

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assessing drive line and final drive operation, and repairing or replacing faulty components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers test and rectification activities associated with wheeled and/or tracked plant/vehicles, drive line and final drive assemblies used in conventional and all wheel drive equipment. Testing and assessment of performance would typically require operation of plant and equipment.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held

<b>Prerequisite units</b>		
		operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess drive line and final drive operation	<p>1.1. Universal and constant velocity joints, conventional/limited slip and locking, differential action and conventional/swing axle operating principles are understood.</p> <p>1.2. Relevant information is obtained and correctly interpreted prior to any testing.</p> <p>1.3. Preliminary checks are undertaken safely and to prescribed procedures.</p> <p>1.4. Faults are correctly isolated to component level and appropriate corrective action is determined.</p> <p>1.5. Test equipment is adapted and used correctly.</p> <p>1.6. Component parts are correctly assessed for reuse or replacement.</p>



ELEMENT	PERFORMANCE CRITERIA
2. Repair/replace faulty components	<p>2.1. Component wear and clearances are correctly determined using appropriate test equipment and manufacturers' recommendations.</p> <p>2.2. Replacement components are correctly selected using manufacturers' data.</p> <p>2.3. Components are removed and refitted to driveline and final drive assemblies following prescribed procedures.</p> <p>2.4. Adjustments are made correctly using appropriate tooling/equipment and manufacturers' data.</p> <p>2.5. Test and repair/replacement activities are accurately recorded.</p> <p>2.6. Drive line and final drive assemblies are free of excessive noise and operate to specification after work is carried out.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- checking the drive line and final drive for correct operation
- using test equipment correctly
- testing the drive line and final drive components for conformance to specification
- removing and refitting components to drive line and final drive assemblies
- adjusting drive line and final drive components using appropriate tools, techniques and equipment
- recording test and work activities
- operating the drive line and final drive assembly free of excessive noise and in conformance to specifications

## REQUIRED SKILLS AND KNOWLEDGE

- undertaking calculations and numerical operations within the scope of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- the principles of operation of drive lines and final drives
- the functions of universal and constant velocity joints, differentials and axles
- the procedures for checking drive lines and final drives for correct operation
- faulty drive line and final drive components
- the appropriate action to correct the faulty component(s)
- the test equipment to be used in checking/testing drive lines and final drives for correct operation
- the procedures for testing drive lines and final drives, including any necessary adaptation of test equipment
- component parts for reuse or replacement.
- the procedures for checking drive line and final drive components for wear and clearance
- the tools, techniques and equipment to be used to determine component wear and clearance
- replacement components using manufacturers' data.
- the procedures for removing and refitting drive line and final drive components
- the procedures for adjusting drive line and final drive components
- the tools, techniques and equipment to be used to maintain and repair drive line and final drive assemblies
- the effects of the adjustments on drive line and final drive operation
- the procedures for recording test and work activities
- the drive line and final drive assembly specifications
- hazards and control measures associate with diagnosing and rectifying drive line and final drives, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to diagnose and rectify drive line and final drives. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with testing and diagnosing drive line and final drives, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18045B Fault find/repair electrical equipment/components up to 250 volts single phase supply

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating and rectifying faults in equipment and components using up to 250 V single phase power where these are disconnected from the electrical supply.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers the competencies required to locate and rectify faults in equipment and components using up to 250 V single phase power, where they are disconnected from their electrical supply. This would also typically cover plug-in appliances.</p> <p>Work is performed onsite.</p> <p>This unit also covers basic mechanical disconnection, dismantling and re-assembly of equipment components, enclosures, drives etc.</p> <p>This unit should not be selected if Unit MEM18046B (Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.) has been selected.</p> <p>When work involves disconnection and reconnection of fixed-wired equipment, Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.) must also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault	<p>1.1. Equipment/<i>component</i> function is determined by reference to circuit diagrams, schematics, manual and/or consultation with technical adviser.</p> <p>1.2. Where required, equipment is correctly isolated from power supply.</p> <p>1.3. Where appropriate, built-in fault indicators and error codes are examined and correctly interpreted, and results are recorded to standard operating procedures.</p> <p>1.4. Equipment/<i>component</i> is checked and tested using correct and <i>appropriate techniques</i>, procedures, tools and <i>test equipment</i>.</p> <p>1.5. Check and test results are correctly interpreted and, where required, verified.</p> <p>1.6. Equipment/<i>component</i> fault is identified and localised.</p> <p>1.7. Equipment/<i>component</i> fault/s are correctly recorded to standard operating procedures.</p>
2. Rectify faults	<p>2.1. Using correct and appropriate techniques, procedures, tools and equipment, equipment/<i>component</i>/s are repaired, replaced or adjusted to specification or manufacturers' requirements.</p> <p>2.2. Equipment/<i>component</i> is checked and tested using correct and appropriate techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</p> <p>2.3. Where appropriate, rectifications report is recorded to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining circuit diagrams, specifications, schematics



## REQUIRED SKILLS AND KNOWLEDGE

- isolating electrical equipment/component from the power supply
- tagging and checking isolated electrical equipment/component
- locating and reading/recording built-in fault indicators
- checking and testing electrical equipment/component for correct operation
- verifying variations from specifications indicated by initial test results
- identifying and localising faults in electrical equipment/ components
- recording/reporting faults in the electrical equipment/components
- repairing, replacing or adjusting electrical equipment/components to specification
- referencing supplier catalogues
- confirming that the electrical equipment/components have been returned to specification
- recording rectification of the electrical equipment/ components

### Required knowledge

Look for evidence that confirms knowledge of:

- operation and characteristics of active and passive components
- basic motor operation of various types
- function of the electrical equipment/component within the circuit
- hazards associated with the electrical equipment/component
- relevant regulatory requirements
- electrical equipment/component isolation procedures
- test equipment to be used to verify isolation of the electrical equipment/circuit
- errors indicated by built-in devices
- the procedures, tools, equipment and techniques to be used to test the operation of the electrical equipment/component
- reasons for selecting the chosen tools, equipment and techniques
- specifications of the electrical equipment/component
- variations between test results and specifications
- procedures for localising faults in electrical equipment/components
- procedures for recording/reporting faults in electrical equipment/components
- techniques/procedures for returning the electrical equipment/components to specification
- adjustments that can be made to electrical equipment/components
- procedures for confirming the electrical equipment/components have been returned to specification
- procedures for recording electrical equipment/component rectifications

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to fault find/repair electrical equipment/components up to 250 V single phase supply. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault finding/repair of electrical equipment/components up to 250 V single phase supply, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Components</b>	Brushes, armatures, windings, relays, programmable controllers or other electronic switching devices
<b>Appropriate fault finding techniques</b>	Testing for voltage, current, frequency, polarity, phase, circuit continuity, insulation resistance, earth continuity etc.
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, multimeters, tong testers, wattmeters, etc.

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18046B Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c.

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers diagnosing, locating and rectifying faults in electrical equipment/components up to 1000 volts a.c./1500 volts d.c.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers locating and rectifying faults in equipment and components using up to 1000 volts a.c./1500 volts d.c. single and multi-phase power where these are disconnected from the electrical supply.</p> <p>Work performed in situ.</p> <p>This unit includes basic mechanical disconnection, dismantling and re-assembly of equipment components, enclosures, drives etc.</p> <p>When work involves disconnection and reconnection of fixed-wired equipment, Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.) must also be selected.</p> <p>Where work involves up to 250 V single phase supply only, Unit MEM18045B (Fault find/repair electrical equipment/components up to 250 volts single phase supply) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 10</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault	<p>1.1.Equipment/component function is determined and understood by reference to circuit diagrams, schematics, manual and/or consultation with technical adviser.</p> <p>1.2.Where appropriate, built-in fault indicators and error codes are examined and correctly interpreted, and results are recorded to standard operating procedures.</p> <p>1.3.Where required, equipment is correctly isolated from power supply.</p> <p>1.4.Equipment/component is checked and tested using correct and appropriate techniques, procedures, tools and test equipment.</p> <p>1.5.Check and test results are correctly interpreted and, where required, verified.</p> <p>1.6.Equipment/component fault is identified and localised.</p> <p>1.7.Equipment/component fault/s are correctly recorded to standard operating procedures.</p>
2. Rectify fault(s)	<p>2.1.Using correct and appropriate techniques, procedures, tools and equipment, equipment/component/s are repaired, replaced or adjusted to specifications or manufacturers' requirements.</p> <p>2.2.Equipment/component is checked and tested using correct and appropriate techniques, procedures tools and equipment for compliance with site or manufacturers' specifications.</p> <p>2.3.Where appropriate, rectifications report is recorded to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

## REQUIRED SKILLS AND KNOWLEDGE

- using diagnostic skills to identify correct and faulty operation
- interpreting and using circuit diagrams, specifications
- isolating electrical equipment/components from the power supply
- tagging isolated electrical equipment/components
- checking electrical equipment/components for isolation from the power supply
- locating and reading/recording built-in fault indicators
- obtaining error code interpretation documents
- checking and testing electrical equipment/components for correct operation
- verifying variations from specifications indicated by initial test results
- identifying and localising faults in electrical equipment/ components
- recording/reporting faults in electrical equipment/components
- repairing, replacing or adjusting electrical equipment/components to specification
- referencing supplier catalogues
- using test instruments to confirm that electrical equipment/components are operating to specification
- recording rectification of the electrical equipment/ components

## Required knowledge

Look for evidence that confirms knowledge of:

- function of the electrical equipment/component within the circuit
- hazards associated with the electrical equipment/component
- relevant regulatory requirements
- electrical equipment/component isolation procedures
- test equipment to be used to verify isolation of the electrical equipment/circuit
- errors indicated by built-in devices
- procedures for testing electrical equipment/components for correct operation
- tools, equipment and techniques to be used to test the operation of the electrical equipment/component
- reasons for selecting the chosen tools, equipment and techniques
- specifications of the electrical equipment/component
- variations between test results and specifications
- procedures for localising faults in electrical equipment/components
- procedures for recording/reporting faults in electrical equipment/components
- appropriate techniques/procedures for returning the electrical equipment/components to specification
- specifications of the electrical equipment/components
- adjustments that can be made to electrical equipment/components
- procedures for confirming the electrical equipment/components have been returned to specification
- procedures for recording electrical equipment/component rectification



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to Fault find/repair electrical equipment/components up to 1000 volts a.c./1500 volts d.c. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault finding/repair of electrical equipment/components up to 1000 volts a.c./1500 volts d.c., or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have

<b>EVIDENCE GUIDE</b>	
	access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment</b>	Single and multi phase motor drive and heating appliances, relays, coils, transformers, thermostats, gauges, illuminating devices, switches, circuit fuses and breakers, etc. using up to 1000 volts a.c.1500 volts d.c. power supplies on non-interconnected circuits
<b>Components</b>	Brushes, armatures, windings, contactors, relays, programmable controllers or other electronic switching devices, switches, fuses, circuit breakers, relays, transformers, semi-conductor devices, regulators, motors, etc.
<b>Appropriate fault finding techniques</b>	Testing for voltage, current, frequency, polarity, phase, circuit continuity, insulation resistance, earth continuity etc.
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, multimeters, tong testers, wattmeters, cathode ray oscilloscopes etc.

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18047B Diagnose and maintain electronic controlling systems on mobile plant

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers testing, diagnosing and maintaining electronic control systems. Path 1
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to testing, diagnosing, fault finding and removing/replacing electronic control systems associated with mobile plant and equipment, including discrete logic, analogue and microprocessor monitoring and control systems.</p> <p>This unit applies to automotive, agricultural and mining environments.</p> <p>Maintenance would typically cover wiring harness faults; testing and identifying faulty sensors, actuators and control components; replacing and making adjustments to input and output components; and accessing data from electronic control unit and applicable manufacturer software/hardware to change operating parameters.</p> <p>Information is sourced from manufacture/technical manuals.</p> <p>All work is undertaken to manufacturers' specifications and standard operating procedures.</p> <p>This competency does not cover the skills needed to repair electronic circuitry associated with these systems. If this skill is required, Units MEM18056B (Diagnose and repair analog equipment and components) and MEM18057B (Maintain/service analog/digital electronic equipment) should be selected as appropriate.</p>
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	<b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18030B	Diagnose and repair low voltage electrical systems
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Access and interpret fault codes	1.1.Applicable control unit is located and identified. 1.2.Fault codes are accessed using vehicle indicators, meters and diagnostic tooling. 1.3.Fault codes are interpreted. 1.4.Fault codes are cleared from memory according to procedures. 1.5.Diagnostic and maintenance procedures are performed using applicable techniques and precautions to safeguard electronic components and systems.
2. Locate and rectify faults using fault codes and manufactures fault finding and rectification procedures	2.1.Fault is traced from fault codes using applicable troubleshooting procedures. 2.2.Faults are rectified to required specification.
3. Locate and test input components	3.1.Input components are located and identified. 3.2.Input components are electrically tested.
4. Locate and test output components	4.1.Output components are located and identified. 4.2.Output components electrically tested.
5. Remove/replace and adjust sensors and actuators	5.1.Component part is removed correctly. 5.2.Correct replacement part is identified. 5.3.Component part replaced correctly. 5.4.Adjustments are made in relation to mechanical clearances and measured electrical and resistance values.
6. Change operating parameters	6.1.Appropriate specifications are sourced from plant/equipment identification and applicable manuals and specifications. 6.2.Appropriate tooling (software/hardware) is selected. 6.3.Plant/equipment identification is used to obtain security codes.

ELEMENT	PERFORMANCE CRITERIA
	6.4.Data is downloaded. 6.5.Data is entered for new specifications. 6.6.Successful data entry is verified.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying the control unit
- using fault codes correctly to access fault codes with indicators, meters or diagnostic tooling
- interpreting fault codes and specifications correctly from applicable manuals
- clearing fault codes from memory and verifying using applicable procedures and manuals
- identifying and applying procedures to safeguard electronic components and systems when diagnosing and maintaining typical mobile plant electronic circuits
- locating and identifying various types of input and output components
- following manufactures' procedures to test output components
- identifying, removing, replacing component parts
- making adjustments in relation to mechanical clearances and measured electrical and resistance values
- selecting tooling (software/hardware) according to manufactures' manual
- obtaining security codes using correct protocol from manufacturer, plant/equipment identification and appropriate identification
- using computer and relevant computer applications including downloading and entering data for new specifications as per manufacturers' procedures

#### Required knowledge

Look for evidence that confirms knowledge of:

- applicable fault codes and their meanings
- procedures to clear fault codes and verify clearance
- sources of potential damage to typical mobile plant electronic systems when performing maintenance and diagnostic work
- techniques and procedures to safeguard against damage

**REQUIRED SKILLS AND KNOWLEDGE**

- correct troubleshooting procedures
- techniques/procedures used to remove and replace faulty components
- various types of input components
- operation and principles of transducers used in control systems
- relevant testing procedures
- component types, functions and locations
- operation and principles of actuators used in control system
- concepts of EPROMs and microprocessors
- procedures to obtain security code
- procedure to download, enter and verify data
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to test, diagnose and maintain electronic controlling systems on mobile plant. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.



**EVIDENCE GUIDE**

	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with testing, diagnosing and maintaining electronic controlling systems on mobile plant, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Faults are rectified</b>	Adjustments and replacements which do not include the repair of components
<b>Input components</b>	Sensors, actuators, resistors, capacitors, diodes, transistors, ICs, EPROMs, microprocessors
<b>Output components</b>	Hardware, software, hard copy devices, soft

RANGE STATEMENT	
	storage devices
Specifications	<ul style="list-style-type: none"> <li>• Manufacturer and/or vendor specifications</li> <li>• Standard operating procedures</li> </ul>

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18048B Fault find and repair/rectify basic electrical circuits

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating and repairing and rectifying faults in non-interconnected electrical circuits.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to working on basic circuit which is defined as a single circuit with a single output. A single circuit may be controlled by one or more devices and the output may control one or more devices.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM10003B	Install and test electrical wiring and circuits (up to 1000 volts a.c./1500

Prerequisite units		
		volts a.c.)
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault	1.1.Circuit function and characteristics are determined and understood by reference to circuit diagrams, specifications, schematics and/or consultation with

ELEMENT	PERFORMANCE CRITERIA
	<p>technical adviser.</p> <p>1.2. Where appropriate, built-in fault indicators and error codes are examined and correctly interpreted, and results are recorded to standard operational procedures.</p> <p>1.3. Where appropriate, circuit is correctly isolated from power supply.</p> <p>1.4. Faults are verified or localised using correct and appropriate techniques, procedures, tools and test equipment.</p> <p>1.5. Faults are recorded to standard operating procedures.</p>
2. Repair/rectify fault(s)	<p>2.1. Using correct and appropriate techniques, procedures, tools and equipment, circuit/s is repaired, replaced or adjusted to specifications or manufacturers' requirements.</p> <p>2.2. Circuit/s is checked and tested using correct and appropriate techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</p> <p>2.3. Where appropriate, repair/rectification report is recorded to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using diagnostic skills to identify correct and faulty operation
- interpreting and using circuit diagrams, specifications
- locating reading/recording built-in fault indicators
- obtaining error code interpretation documents
- isolating electrical circuits from the power supply
- tagging isolated circuits
- verifying circuit isolation
- confirming/localising circuit faults using appropriate test equipment, work

**REQUIRED SKILLS AND KNOWLEDGE**

techniques and tools

- recording/reporting faults in electrical circuits
- repairing/adjusting electric circuits
- confirming circuit/s against specification
- recording rectification of the circuit(s)

**Required knowledge**

Look for evidence that confirms knowledge of:

- circuit characteristics
- hazards associated with the electrical circuit(s)
- relevant regulatory requirements
- errors indicated by built-in devices
- circuit isolation procedures
- common electrical test instruments and their application
- common techniques for testing electrical circuits
- recording/reporting requirements for electrical circuit faults
- appropriate techniques/procedures for returning the circuit/s to specification
- site/manufacturers' circuit specifications
- requirements for recording circuit rectifications

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to fault find and repair/rectify basic electrical circuits. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault finding and repair/rectify of basic electrical circuits, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b>Circuit</b>	A basic circuit is defined as a single circuit with a single output. A single circuit may be controlled by one or more devices and the output may control one or more devices
<b>Appropriate techniques</b>	Testing for voltage, current, frequency, polarity, phase, circuit continuity, insulation resistance, earth continuity etc.
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, multimeters, tong testers, wattmeters, cathode ray oscilloscopes, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18049C Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers connecting and disconnecting equipment. This unit applies to all voltage levels up to 1000 volts a.c./1500 volts d.c.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to disconnection of equipment including electric motors, modular sensing devices and limit switches.</p> <p>Work is performed on site and may include the original connection of fixed wire equipment. All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Electrical licensing may be required by state authorities.</p> <p>If power tools are used, Unit MEM18002B (Use power tools/hand held operations) must also be selected.</p> <p>Where installation and testing of electrical wiring and circuitry up to 1000 volts a.c. and 1500 volts d.c. is required Unit MEM10003B (Install and test electrical wiring and circuits up to 1000 volts a.c./1500 volts d.c.) must be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 3</b></p>
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## Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

Prerequisite units		
	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Disconnect	1.1.Electrical characteristics of equipment and circuit

ELEMENT	PERFORMANCE CRITERIA
equipment	<p>are determined by reference to circuit drawings, schematics, reference manuals, equipment specifications, identification plate and/or consultation with technical adviser.</p> <p>1.2. Where appropriate, equipment characteristics are determined and recorded to standard operating procedures (rotation etc.).</p> <p>1.3. Point/s of isolation are identified using correct and appropriate procedure.</p> <p>1.4. Equipment is isolated using correct and appropriate techniques and procedures.</p> <p>1.5. All lock-off equipment and signage requirements are used correctly and appropriately.</p> <p>1.6. Electrical isolation is proven using correct and appropriate techniques, procedures and test equipment.</p> <p>1.7. Conductor layout is noted, recorded and labelled to standard operating procedure.</p> <p>1.8. Conductors are disconnected using correct and appropriate techniques, procedures, tools and equipment.</p> <p>1.9. Disconnected cables/connections are terminated and made safe to standard operating procedures.</p>
2. Connect equipment	<p>2.1. Characteristics of the equipment to be connected are identified and connection requirements are determined.</p> <p>2.2. Circuit is checked for safe isolation using correct and appropriate techniques, procedures and test equipment.</p> <p>2.3. Connections are checked and conductors are prepared for termination using correct and appropriate tools and procedures.</p> <p>2.4. Conductors are connected to equipment to specifications using correct and appropriate techniques, tools and equipment.</p> <p>2.5. All cables/wires/conduit are fastened/sealed to specifications using correct and appropriate techniques, tools and equipment.</p> <p>2.6. All lock-off equipment and signage are removed using standard operating procedures.</p> <p>2.7. Equipment and circuit are checked and tested for compliance with specifications using correct and appropriate techniques, procedures, tools and</p>

ELEMENT	PERFORMANCE CRITERIA
	equipment.
3. Perform emergency first aid	<p>3.1. Situation is assessed to identify points of danger to the injured person and potential rescuer.</p> <p>3.2. Rescue/recovery of injured person or assistance to injured person is undertaken in accordance with recognised standards/procedures. Contact is made with the appropriate medical and rescue authorities.</p> <p>3.3. Details of first aid given are recorded.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining and recording equipment characteristics and isolation points from relevant circuit diagrams, specifications, schematics of fixed wired equipment
- isolating fixed wired equipment
- using lock-off equipment and tags/signs
- proving electrical isolation
- labelling conductors and recording their layout
- disconnecting conductors
- making safe disconnected cables/connections
- checking circuits for safe isolation prior to reconnecting
- checking connections and preparing conductors for termination
- checking continuity of the protective earth conductor to determine whether it is sufficiently low
- testing the resistance between the protective earth conductor and the neutral conductor to determine whether it is sufficiently low - not greater than 2 Ohms
- testing the insulation resistance of active conductors to confirm that it is greater than 1 Megohm
- connecting conductors to equipment
- fastening/sealing cables/wires/conduits to specifications
- removing lock-off equipment and signage
- checking and testing equipment and circuits for conformance to specifications
- applying procedures for movement/treatment of injured, including:

## REQUIRED SKILLS AND KNOWLEDGE

- safe rescue of victim from a live situation
- clearing of airways
- CPR (cardio-pulmonary resuscitation)
- care of spinal injuries
- treatment of cuts/lesions etc.
- treatment of burns/scalds
- treatment of shock
- using language and literacy skills to meet recording and reporting requirements related to this unit

## Required knowledge

Look for evidence that confirms knowledge of:

- basic knowledge of electrical theory for the operation of the circuit/equipment
- hazards associated with the circuits and the equipment
- relevant regulatory requirements
- procedures for determining equipment characteristics
- procedures for recording equipment characteristics
- tools, techniques and equipment required to determine equipment characteristics
- point(s) of isolation for the fixed wired equipment
- reasons for selecting the chosen isolation point(s)
- safe isolation and proving dead
- the range of isolation procedures for the fixed wired equipment
- lock-off equipment and signs to be used
- reasons for using and procedures for lock-off equipment and signage
- tools, techniques and equipment to be used to prove electrical isolation
- procedures for proving and removing electrical isolation
- procedures for labelling conductors and recording conductor layout
- tools, techniques and equipment to be used to disconnect conductors
- procedures for disconnecting conductors
- procedures for terminating disconnected cables/connections
- characteristics of the circuit and the equipment
- tools, techniques and equipment to be used to terminate conductors and check connections
- procedures for terminating conductors and checking connections
- specifications for the connections to be made
- tools, techniques and equipment to be used to connect the conductors to the equipment
- procedures for connecting conductors to equipment
- tools, techniques and equipment to be used to fasten and seal the cables, wires and conduits

## REQUIRED SKILLS AND KNOWLEDGE

- procedures for fastening and sealing cables, wires and conduits
- operational specifications of the fixed wired equipment
- tools, techniques and equipment to be used to check and test the compliance of the equipment with specifications
- procedures for checking the operation of the equipment and circuits
- potential dangers
- recognised procedures for the movement and treatment of the injured person
- appropriate local medical and rescue services
- procedures for recording first aid

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with disconnecting/reconnecting fixed wired equipment up to 1000 volts a.c./1500 volts d.c., or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Equipment</b>	As defined in the licensing requirements
<b>Isolation refers to</b>	Safe disconnection of all electrical power to equipment or equipment supply circuits via switching, circuit breakers or fuses etc. On circuits/equipment using up to 1000 volts a.c. or 1500 volts d.c. single or multi-phase supply
<b>Test equipment</b>	Voltmeters, multimeters, tong testers and a range of hand tools such as pliers, screwdrivers, sockets

RANGE STATEMENT	
	and spanners
<b>Connect equipment</b>	Refers to reconnection of existing equipment or the replacement on a 'like for like' basis with no alteration to existing fixed wiring

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance&diagnostics
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## MEM18050C Disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c.

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers connecting and disconnecting equipment. This unit applies to all voltage levels above 1000 volts a.c./1500 volts d.c.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work performed on site and undertaken using predetermined standards of quality, safe work procedures and regulatory and legislative requirements.</p> <p>Persons undertaking this work would be appropriately recognised and endorsed by relevant statutory authorities where required.</p> <p>If power tools are used, Unit MEM18002B (Use power tools/hand held operations) must also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 3</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Disconnect equipment	<p>1.1. Electrical characteristics of equipment and circuit are determined by reference to circuit drawings, schematics, reference manuals, equipment specifications, identification plates and/or consultation with technical adviser.</p> <p>1.2. Where appropriate, equipment characteristics are determined and recorded to standard operating</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>procedures (rotation etc.).</p> <p>1.3.Points of isolation are identified using correct and appropriate procedures incorporating access permits where required.</p> <p>1.4.Equipment is isolated using correct and appropriate techniques and procedures.</p> <p>1.5.All lock-off equipment and signage requirements are used correctly and appropriately.</p> <p>1.6.Electrical isolation is proven using correct and appropriate techniques, procedures and test equipment.</p> <p>1.7.Conductor layout is noted, recorded and labelled to standard operating procedures.</p> <p>1.8.Conductors are disconnected using correct and appropriate techniques, procedures, tools and equipment.</p> <p>1.9.Disconnected cables/connections are made safe to standard operating procedures and access permits are issued where required.</p>
2. Connect equipment	<p>2.1.Characteristics of the equipment to be connected are identified and connection requirements are determined.</p> <p>2.2.Circuit is checked for safe isolation using correct and appropriate techniques, procedures and test equipment.</p> <p>2.3.Connections are checked and prepared for termination using correct and appropriate tools and procedures.</p> <p>2.4.Conductors are connected to equipment to specifications using correct and appropriate techniques, tools and equipment.</p> <p>2.5.All cables/wires/conduit are fastened/sealed to specifications, using correct and appropriate techniques, tools and equipment.</p> <p>2.6.All lock-off equipment and signage is removed using standard operating procedures.</p> <p>2.7.Equipment and circuit is checked and tested for compliance to specifications using correct and appropriate techniques, procedures, tools and equipment.</p>
3. Perform emergency first aid	<p>3.1.Situation is assessed to identify points of danger to the injured person and potential rescuer.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>3.2. Rescue/recovery of injured person or assistance to injured person is undertaken in accordance with recognised standards/procedures and contact is made with appropriate medical and rescue authorities.</p> <p>3.3. Details of first aid given are recorded.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining and recording equipment characteristics from relevant circuit diagrams, specifications, schematics
- correctly identifying the point(s) of isolation of fixed wired equipment
- proving electrical isolation
- isolating fixed wired equipment
- applying earths and lock-off equipment and signs
- labelling conductors and recording their layout
- disconnecting conductors
- terminating disconnected cables/connections
- checking circuits for safe isolation
- checking connections and preparing conductors for termination
- checking continuity of the protective earth conductor to determine whether it is sufficiently low
- testing the resistance between the protective earth conductor and the neutral conductor to determine whether it is sufficiently low - not greater than 2 Ohms
- testing the insulation resistance of active conductors to confirm that it is greater than 1 Megohm
- connecting conductors to equipment
- fastening/sealing cables/wires/conduits to specifications
- removing earths and lock-off equipment and signage
- checking and testing equipment and circuits for conformance to specifications
- applying procedures for movement/treatment of injured, including:
  - HV (high voltage) rescue
  - clearing of airways

## REQUIRED SKILLS AND KNOWLEDGE

- CPR (cardio-pulmonary resuscitation)
- care of spinal injuries
- treatment of cuts/lesions etc.
- treatment of burns/scalds
- treatment of shock
- identifying possible risks associated with this work
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures
- following oral instructions

### Required knowledge

Look for evidence that confirms knowledge of:

- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment for disconnecting/reconnecting fixed wired equipment over 1000 volts a.c./1500 volts d.c.
- safe work practices and procedures
- characteristics of the circuit and the equipment
- hazards associated with the circuits and the equipment
- relevant regulatory requirements
- point(s) of isolation for the fixed wired equipment and reasons for selecting the particular isolation point(s)
- reasons for using earthing, lock-off equipment and signs
- clearances from live parts
- safe isolation
- specifications for the connections to be made
- operational specifications of the fixed wired equipment
- potential dangers of the work covered in this unit
- recognised procedures for the movement and treatment of the injured person
- appropriate local medical and rescue services
- procedures for incident reporting
- procedures, techniques, tools and equipment to be used for:
  - determining and recording equipment characteristics
  - isolating the fixed wired equipment
  - proving electrical isolation
  - labelling conductors and recording conductor layout
  - disconnecting conductors
  - terminating disconnected cables/connections
  - checking circuits for safe isolation

## REQUIRED SKILLS AND KNOWLEDGE

- terminating conductors and checking connections
- connecting the conductors to the equipment
- fastening and seal the cables, wires and conduits
- removing lock-off equipment and signage
- checking the operation of the equipment and circuits
- checking and testing the compliance of the equipment with specifications

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to disconnect/reconnect fixed wired equipment over 1000 volts a.c./1500 volts d.c. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with disconnecting/reconnecting fixed wired equipment over 1000 volts a.c./1500 volts d.c., or other units

<b>EVIDENCE GUIDE</b>	
	requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Appropriate techniques and procedures</b>	Includes clearances for safe approach as mandated by statutory authorities
<b>Isolation</b>	Isolating supply for safe disconnection of all electrical power to equipment supply circuit with switch circuit breaker or fuses etc.
<b>Connection</b>	Disconnection/reconnection and making safe for maintenance of equipment
<b>Circuit</b>	Applies to voltage levels above 1000 volts a.c. and 1500 volts d.c.

## RANGE STATEMENT

<b>Tools and equipment</b>	In accordance with voltage and fault limiting requirements appropriate proving dead meters, high potential testers, voltmeters and a range of hand held tools such as pliers, screwdrivers, sockets, spanners, keys, earthing links, operating sticks etc.
<b>Signage</b>	Tags, access permit holders, restricted access signs

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18051B Fault find and repair/rectify complex electrical circuits

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating and repairing and rectifying faults in interconnected electrical circuits.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to interconnected electrical circuits where electrical equipment and or components are connected electrically, that is there are multiple electrical power supplies or sources, voltages or circuits which are found in the control or switching of the circuit.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM10002B	Terminate and connect electrical wiring
	MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c./1500 volts d.c.)
	MEM12002B	Perform electrical/electronic measurement
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18048B	Fault find and repair/rectify basic electrical circuits
	MEM18049C	Disconnect/reconnect fixed wired equipment which use up to 1000 volts a.c./1500 volts d.c.

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault	<p>1.1.Circuit/system function and characteristics are determined by reference to circuit diagrams, specifications, schematics and/or consultation with technical adviser.</p> <p>1.2.Where appropriate, built-in fault indicators and error codes are examined and correctly interpreted, and results are recorded to standard operational procedures.</p> <p>1.3.Where appropriate, circuit(s) are correctly isolated from power supply.</p> <p>1.4.Faults are verified or localised using correct and appropriate techniques, procedures, tools and test equipment.</p> <p>1.5.Faults are recorded to standard operating procedures.</p>
2. Repair/rectify fault(s)	<p>2.1.Circuit/system is repaired, replaced or adjusted to specifications or manufacturers' requirements using correct and appropriate techniques, procedures, tools and equipment.</p> <p>2.2.Circuit/system is checked and tested using correct and appropriate techniques, procedures, tools and equipment for compliance with site or manufacturers' specifications.</p> <p>2.3.Where appropriate, repair/rectification report is recorded to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- using diagnostic skills to identify and correct faulty operation
- managing multiple processes
- interpreting and using relevant circuit diagrams, specifications, schematics
- locating reading/recording built-in fault indicators
- interpreting error code documents
- isolating electrical circuits from the power supply
- tagging isolated circuits
- verifying circuit isolation
- confirming/localising circuit faults using appropriate test equipment, work techniques and tools
- recording/reporting faults in electrical circuits
- repairing/adjusting electric circuits
- confirming circuit/s against specification
- recording rectification of the circuit(s)

**Required knowledge**

Look for evidence that confirms knowledge of:

- circuit characteristics
- hazards associated with the electrical circuit(s)
- relevant regulatory requirements
- errors indicated by built-in devices
- circuit isolation procedures
- common electrical test instruments and their application
- common techniques for testing electrical circuits
- recording/reporting requirements for electrical circuit faults
- appropriate techniques/procedures for returning the circuit/s to specification
- site/manufacturers' circuit specifications
- requirements for recording circuit rectifications
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to fault find and repair/rectify complex electrical circuits. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault finding and repairing/rectifying complex electrical circuits, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Circuit**

A complex circuit is defined as interdependent circuits

**Appropriate techniques**

Testing for voltage, current, frequency, polarity, phase, phase rotation, circuit continuity, insulation resistance, earth continuity etc.

**Test equipment**

Continuity testers, ammeters, voltmeters, multimeters, tong testers, wattmeters, cathode ray oscilloscopes, etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18052B Maintain fluid power systems for mobile plant

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers testing, fault finding and rectifying basic fluid power systems used in the earthmoving, agricultural and transport industries.
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### Application of the Unit

<b>Application of the unit</b>	<p>The general servicing of systems is also covered by this unit and includes fluid replacement, filtration requirements and oil sampling.</p> <p>This competency does not cover skills required in the design or modification of systems, component re-manufacture or the diagnosis, maintenance and repair of control systems (solenoid and electro proportional systems).</p> <p>If these skills are required, then Units MEM18023B (Modify fluid power system operation), MEM18047B (Diagnose and maintain electronic controlling systems on mobile plant) and MEM18053B (Modify fluid power control systems) should be selected as appropriate.</p> <p>Where Unit MEM18020B (Maintain hydraulic system components) and/or MEM18021B (Maintain hydraulic systems) are selected, this unit should not be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Secure system from	1.1.Sources of stored energy are identified.

ELEMENT	PERFORMANCE CRITERIA
potentially hazardous situations	<p>1.2.Mobile plant is assessed for potentially hazardous situations and conditions.</p> <p>1.3.Accumulators and position actuators are bled down to remove stored energy as per manufacturers' instructions.</p>
2. Check hydraulic system components	<p>2.1.System <i>components</i> are identified correctly, using appropriate circuit diagrams or manufacturers' instruction.</p> <p>2.2.Faults are traced and localised with reference to manufacturer troubleshooting procedures and flow charts.</p> <p>2.3.The operational function of components is inspected and tested in accordance with standard operating procedures.</p>
3. Replace faulty system components	<p>3.1.Faulty components are correctly removed from system using appropriate tools, techniques and procedures.</p> <p>3.2.Replacement components are sourced where appropriate from manufacturer/supplier.</p> <p>3.3.Hoses, tubes and pipework are prepared and assembled using appropriate tools, techniques and procedures.</p> <p>3.4.Replacement components and conductors are correctly assembled and refitted to system.</p> <p>3.5.System is tested and adjusted for correct operation according to standard operating procedures.</p>
4. Dismantle, inspect and rectify linear actuators	<p>4.1.Hydraulic cylinders and rams are dismantled using appropriate tools, techniques and procedures.</p> <p>4.2.Component parts are evaluated for condition.</p> <p>4.3.Seals and bearings are fitted as per manufacturer specifications.</p> <p>4.4.Cylinders/rams are reassembled and fitted as per manufacturer instructions.</p> <p>4.5.Assembly is tested by use of machine circuit or equivalent.</p>
5. Service hydraulic systems	<p>5.1.Hydraulic systems are serviced according to manufacturers' schedules and instructions.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- checking for conformance to specification
- identifying sources of stored energy on mobile plant
- identifying hazardous situations/conditions and applying appropriate safety measures
- bleeding accumulators down and positioning actuators correctly
- tracing faulty components and localising using fluid power principles, procedures and safety requirements
- using equipment for testing hydraulic system component
- inspecting and testing components including hoses, pipes, actuators, pumps, valves, cylinders and rams according to procedure and using fluid power
- removing components from system
- identifying replacement pipes and hoses using catalogues or electronic media
- obtaining replacement parts using appropriate procedures
- selecting appropriate conductors and fittings from manufacturer catalogues and charts
- cutting conductors to length using appropriate tooling/machine
- assembling conductors using correct techniques
- replacing component parts correctly in system using appropriate tools and techniques
- testing and adjusting replacement components for correct operation and conformance to specifications
- conducting conductor assemblies using machine circuits
- dismantling linear actuators without damage, using correct tools, techniques/procedures and safety measures
- locating and using specifications to identify performance/condition of cylinders and rams
- identifying wear and damage to cylinders and rams
- fitting seals and bearings
- reassembling cylinder/ram in correct sequence as per manufacturer instruction
- refitting assembly correctly to machine

## REQUIRED SKILLS AND KNOWLEDGE

- testing refitted assemblies and verifying repairs on machine circuit and/or test rig
- carrying out general service procedures correctly
- undertaking calculations and numerical operations within the scope of this unit
- recording/reporting service activities

### Required knowledge

Look for evidence that confirms knowledge of:

- different sources of stored energy and their applications
- hazards and control measures associated with maintenance and rectification of fluid power systems, including housekeeping
- the reasons for bleeding accumulators and actuators and the hazards associated with working on pressurised systems
- the full range of hydraulic system components in a mobile plant application
- information on circuit diagram or manufacturer instructions
- the characteristics and operational function of each system component
- methods and techniques for tracing and localising faults
- the procedures and equipment for inspecting and testing hydraulic system components
- problems relating to faulty hydraulic system components/operation
- the specifications of each hydraulic system component
- the reasons for hydraulic components not operating in accordance with specifications
- all safety procedures and precautions
- common faults in hydraulic components
- removal methods for various components
- information in catalogues or electronic media
- procedures to obtain replacement parts
- typical conductor types and fittings their applications
- methods for cutting/assembling hoses/tubes/pipework
- tools and techniques for fitting replacement components and conductors
- the correct operation of hydraulic components and conductors
- the procedures for checking and adjusting the system
- the tools, techniques and procedures used for dismantling
- safety measures for dismantling linear actuators
- the methods of inspection and measurement
- guides and specifications for reusable parts
- the correct procedures for fitting bearings and seals
- the sequence and procedure for reassembly of cylinder/ram
- assembly and fitting instructions
- the procedures for refitting rams
- the procedures for testing and verifying repairs using machine circuits and/or test

**REQUIRED SKILLS AND KNOWLEDGE**

rigs

- necessary remedial action
- manufacturer scheduled service timeframes and service items
- service procedures
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain fluid power systems for mobile plant. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining fluid power systems for mobile plant, or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Check**

Pressure and flow testing, cycle times, basic interrogation of diagnostic system and basic electronic servicing

**Components**

Hoses, pipes, actuators, pumps, valves, cylinders and rams

**Service of hydraulic systems**

Change out of hydraulic components such as pumps, valves and actuators and the associated remedial actions required such as system flushing and purging and setting of component parameters

**Rectify**

May include the assembly and fitting of hydraulic hoses, tubing and pipework. Resealing and repairs to cylinders and rams.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18053B Modify fluid power control systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking and testing software programs, controlling system inputs and outputs, repairing faulty system inputs and outputs, and preparing a service report.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers the skills required to alter the control parameters of fluid power control systems by system modification; this includes the ability to assess system performance based on sound working knowledge of established principles, methods and procedures.</p> <p>System specifications are interpreted/understood from data sheets, circuit diagrams and flow diagrams. Corrections, modifications/alterations are undertaken to specifications to parts of the control system including software timers, gates, associated equipment, flow, ladder and logic diagrams. Fault finding of system hardware input/outputs includes input/output circuitry, cards, external sensors, limits, mnemonic coding and associated equipment. Service reports are prepared according to standard operating procedure. Programmable controllers include PLC and DCS or similar.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM12025A	Use graphical techniques and perform simple statistical computations
	MEM14005A	Plan a complete activity
	MEM16010A	Write reports
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18016B	Analyse plant and equipment condition monitoring results
	MEM18018C	Maintain pneumatic system components
	MEM18019B	Maintain pneumatic systems
	MEM18020B	Maintain hydraulic system components
	MEM18021B	Maintain hydraulic systems
	MEM18022B	Maintain fluid power controls
	MEM18023B	Modify fluid power system operation

<b>Prerequisite units</b>		
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check/test control software program	<p>1.1. Program steps are checked against manufacturers' and site specifications using schematics, circuit and ladder diagrams.</p> <p>1.2. Deviations are determined and recorded.</p>
2. Correct or modify control system software/program	<p>2.1. Program deviations are corrected and aligned to specification requirements using standard operating procedures.</p> <p>2.2. <i>Modifications</i> to program are undertaken to specification requirements using standard operating procedures.</p> <p>2.3. Modification is recorded to standard operating procedures.</p> <p>2.4. Modified program is backed up to standard operating procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Check/test control system inputs/outputs	3.1. Input/output signals are checked and assessed against operational specifications using correct and appropriate techniques, tools and equipment. 3.2. Faulty signals are identified, repaired and recorded/reported to appropriate personnel.
4. Repair faulty control system input/output	4.1. Faulty signal source is repaired and/or replaced. 4.2. Repaired/replaced signal source is tested for correct operation in system and commissioned in conformance to operational specifications.
5. Prepare service report	5.1. Service report is prepared and completed following standard operating procedure. 5.2. Recommendations for improvement and repeat downtime avoidance analysis are included.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings, circuit and ladder diagrams and other applicable documents
- planning and sequencing operations
- checking and clarifying task-related information
- identifying, recording and correcting deviations of control software program from specification
- modifying control system software/program and recording modifications
- backing up the modified control system program
- checking the input and output signals for conformance to specification using appropriate tools, equipment and techniques in accordance with standard operating procedures
- identifying, recording and correcting faulty signals
- marking the source of the faulty signal for repair or replacement
- obtaining and using supplier catalogues
- testing repaired/replaced signal source for correct operation in accordance with

**REQUIRED SKILLS AND KNOWLEDGE**

- specifications and standard operating procedures
- commissioning the repaired/replaced signal source
- documenting all required service details

**Required knowledge**

Look for evidence that confirms knowledge of:

- the operational specifications of the control system
- the program steps and their function
- the procedures for recording deviations of the control software program from specification
- the procedures for correcting deviations of the control system software from specification
- the modifications to be made to the control system software and reasons for modifying the control system software
- the procedures for recording control system software modifications
- the procedures for backing up modifications to control system programs
- the tools, equipment and techniques to be used to check input and output signals for conformance to specification
- the procedures for recording/reporting faulty input/output signals
- the procedures for marking items for repair or replacement
- the tools, equipment and techniques necessary to repair the signal source
- the disassembly/assembly procedures to be followed when repairing signal sources
- the specifications of the signal source
- the procedures for testing signal sources
- the procedures for commissioning signal sources into operation
- the procedures for reporting service undertaken on control systems
- any trends and probable causes, evident in the data collected and collated
- reasons for recommended improvements
- safe work practices and procedures
- hazards and controls associated with modifying fluid power controls, including housekeeping

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to modify fluid power control systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying fluid power control systems or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Control system</b>	PCs, programmable controllers, DCS, relay logic (electric-hydraulic-pneumatic) etc.
<b>Modifications</b>	Modifications covered by this unit are changes to fluid power control systems that lead to desired changes in system performance

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18054B Fault find, test and calibrate instrumentation systems and equipment

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the testing of instrumentation systems and equipment; applying data collection techniques and localising fault conditions; analysing and reporting test results; and calibrating instrumentation systems and components.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to undertaking test procedures to determine the correct operational function of electrical, electronic mechanical, fluid power systems, equipment, components and associated items.</p> <p>It extends to the use of mechanical, pneumatic/electro-pneumatic, electronic (analog/digital) and associated instruments, measuring variables such as temperature, level, pressure, flow rate, current, resistance, voltage, levels, light, density or any other process variable.</p> <p>Tasks are undertaken in workshop/site, laboratory environments.</p> <p>Operational function of instrumentation equipment/components is tested and assessed against operational specifications, and interpreted from data sheets and circuit diagrams in consultation with appropriate personnel where applicable.</p> <p>Soldering/desoldering of electrical/electronic components requires the selection of Unit MEM05001B (Manual soldering/desoldering - electrical/electronic components) or Unit MEM05002B (Perform high reliability soldering and desoldering) as appropriate.</p> <p>High reliability covers soldering/desoldering for the installation and fabrication of electrical/electronic</p>
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	<p>components to advanced or military specifications, or where the reliability of electrical connections is critical. It also covers the soldering of electronic components where prevention of damage through electrostatic discharge or other means is required.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation and A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment

<b>Prerequisite units</b>		
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18064B	Maintain instrumentation system components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Test instrumentation	1.1. Work/test requirements are identified and defined

ELEMENT	PERFORMANCE CRITERIA
systems and equipment	<p>to standard operating procedures.</p> <p>1.2. Correct test application principles are selected after inspection of instrumentation systems, equipment/components.</p> <p>1.3. Appropriate test equipment is selected in accordance with defined requirements.</p> <p>1.4. Device isolation methods/requirements are observed and localised.</p> <p>1.5. Appropriate test procedures and application principles are applied in assessing operation of instrumentation systems, equipment/components.</p> <p>1.6. Normal operating characteristics of instrumentation systems, equipment/components are applied to the level necessary to identify and localise faults.</p> <p>1.7. Characteristics/operational function assessment procedures are applied according to safety and regulatory/site specifications.</p> <p>1.8. Characteristics and operational function is checked and verified.</p>
2. Apply data collection techniques and localise fault conditions	<p>2.1. Drawings/diagrams and operational specifications are utilised in identifying and localising fault conditions.</p> <p>2.2. Where appropriate, built-in fault indicators, error codes are examined and correctly interpreted and results are recorded to standard operating procedures.</p> <p>2.3. Fault condition is localised to major component level using appropriate test equipment principles and procedures.</p>
3. Analyse and report test results	<p>3.1. Test results are analysed/verified against operational specifications and localised faults are confirmed.</p> <p>3.2. Potential and real faults are reported using standard operating procedures.</p> <p>3.3. Faulty conditions are evaluated and corrective action is planned.</p> <p>3.4. Action plan is recorded and documented according to standard operating procedures.</p>
4. Calibrate instrumentation equipment/components	<p>4.1. Zero, span and range checks are undertaken on indicators/controllers using correct and appropriate configuration.</p> <p>4.2. Where applicable, methods of adjustment using</p>

ELEMENT	PERFORMANCE CRITERIA
	calibration devices are performed and documented to prescribed procedures and operational specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant data with respect to the operation of the instrumentation systems/equipment
- locating, inspecting and testing a range of instrumentation system components
- isolating instrumentation system/equipment
- interpreting all relevant instrumentation circuits, drawings, instructions, manuals and data sheets
- checking the individual components within the instrumentation system for correct operation
- dismantling, repairing and reassembling faulty components
- selecting correct replacement parts from the manufacturer/supplier catalogues
- checking repaired/replaced instrumentation system components for correct operation
- complete service reports, and language and literacy skills for recording/documenting test results
- checking and verifying the operational functions of the instrumentation system/equipment including reading/recording built-in indicators
- obtaining error code interpretation documents
- undertaking zero, span and range checks on instrumentation systems/equipment
- calibrating instrumentation system/equipment

#### Required knowledge

Look for evidence that confirms knowledge of:

- instrumentation principles such as controlling density, level, flow, temperature, composition of a range of materials
- effects of resistance, capacitance, inductance and impedance (R,L,C) upon electrical circuit

**REQUIRED SKILLS AND KNOWLEDGE**

- interpretation requirements of schematic, wiring and block diagrams and circuits
- principles of hydraulic, pneumatic and electrical flow
- calibration procedures of instrumentation systems and equipment/components
- purpose/operational function of instrumentation system
- procedures and equipment for inspecting and testing instrumentation system
- specifications of each instrumentation system and acceptable deviations from specifications
- procedures for repairing faulty instrumentation system
- dismantling, reassembly and testing techniques
- correct operation of the instrumentation system including the procedures for isolating instrumentation systems
- range of faults in instrumentation system/equipment components
- procedures for checking and verifying the operational function of the instrumentation system/equipment
- procedures for recording and completing service reports
- hazards associated with fault-finding, testing and calibrating instrumentation systems/equipment
- the operational specifications of the instrumentation system/equipment
- variations between test results and operational specifications
- probable causes of faults in instrumentation system/equipment components
- action to be taken to rectify the causes of faults in instrumentation systems/equipment
- the sequence of events to be undertaken to correct faults in the instrumentation system/equipment components
- errors indicated by built-in devices
- methods of determining procedures
- procedures for reporting faults
- the difference between real and potential faults
- procedures for recording/documenting test and calibration results
- the function and procedures for zero, span and range checks on instrumentation systems/equipment
- equipment required to carry out the calibration of instrumentation systems/equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to fault find, test, calibrate instrumentation systems and equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault finding, testing, calibrating instrumentation systems and equipment or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Instrumentation systems</b>	Made up of more than one interdependent component controlling and processing multiple inputs and/or outputs
<b>Equipment</b>	Process machines, temperature control systems, sterilisation units, water cooling/filtration systems; equipment utilising mechanical, pneumatic/electro-pneumatic or electronic principles, associated instruments measuring level, pressure light, flow, current, resistance, voltage, density, temperature
<b>Components</b>	Sensors, transmitters, converters, indicators, analysers, controllers, transducers, power supplies, removable circuit boards and sensor units associated with determining/controlling density, level, flow, temperature, composition etc. of a range of materials
<b>Test equipment</b>	System calibrators, manometers, dead weight testers, wheatstone bridge, potentiometers, frequency/signal generators, logic probes, multimeters, (analog/digital), test gauges, cathode ray oscilloscopes and other associated equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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# MEM18055B Dismantle, replace and assemble engineering components

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers dismantling and identifying faulty components, selecting replacements, and assembling engineering components into assemblies or sub-assemblies in accordance with standard operating procedures.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit involves dismantling, checking, replacing and assembling engineering components in accordance with standard operating procedures.</p> <p>All specifications are interpreted from manufacturers' manuals, engineering drawings, detailed/technical sketches and associated data sheets. Tasks are undertaken utilising engineering principles, designated procedures, appropriate tools, equipment and safe workshop practices.</p> <p>Work is undertaken autonomously or in a team environment using predetermined standards of quality, safety and workshop procedures.</p> <p>Where fitting techniques and principles are required to assess component condition, and/or modify components to achieve precision fits, unit MEM18006C (Repair and fit engineering components) should also be selected.</p> <p>Where precision mechanical measurement is required, then Unit MEM12003B (Perform precision mechanical measurement) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 3</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Dismantle engineering	1.1.Engineering components are inspected and task

ELEMENT	PERFORMANCE CRITERIA
components	requirements are analysed. 1.2.Appropriate tools and equipment are selected and component/s are prepared for dismantling. 1.3.Component is dismantled using standard operating procedures, tools and equipment. 1.4.Engineering components are clearly marked to aid reassembly.
2. Identify faulty components	2.1.Specifications for components are obtained from appropriate source and are interpreted and understood. 2.2.Damaged or faulty components are assessed against specifications according to standard operating procedures. 2.3.Faulty components are identified for repair, replacement or adjustment according to standard operating procedures.
3. Select replacement components	3.1.Where applicable, replacement and/or repaired parts are selected for reassembly according to standard operating procedures.
4. Assemble engineering components into assemblies or sub-assemblies	4.1.Appropriate techniques are applied in the preparation, assembly and adjustment of components using fastening equipment and methods which ensure conformance to specifications, operational performance, quality and safety of the completed assembly according to standard operating procedures. 4.2.Correct lubrication, packing, sealing materials are selected and applied correctly in conformance to job specifications. 4.3.Final component assembly is inspected, tested and adjusted as necessary for compliance with operational specifications and returned to use according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

**REQUIRED SKILLS AND KNOWLEDGE****Required skills**

Look for evidence that confirms skills in:

- obtaining and interpreting all relevant instructions, standard operating procedures, drawings and specifications
- preparing component for dismantling
- dismantling components using appropriate techniques, tools and equipment
- marking component parts appropriately for identification purposes
- checking components visually and dimensionally for conformance to specification
- where appropriate, marking faulty parts for repair, replacement or adjustment
- selecting and confirming replacement parts to specifications
- obtaining and using all relevant supplier catalogues
- preparing and assembling components using appropriate techniques in accordance with standard operating procedures
- where appropriate, applying lubricants correctly to the assembly in accordance with specifications and standard operating procedures
- where appropriate, applying packing and/or sealing materials in accordance with specifications and standard operating procedures
- inspecting and checking the final assembly for conformance to specification
- where appropriate, returning the final assembly to use

**Required knowledge**

Look for evidence that confirms knowledge of:

- tasks to be performed in accordance with standard operating procedures
- procedures for dismantling the assembly
- tools and equipment to be used to dismantle the components
- procedures and required equipment for checking components for conformance to specification
- specifications of the components to be replaced
- features and/or dimensions upon which replacement parts are to be selected
- process of identifying replacement parts from "third party" suppliers' catalogues
- procedures for assembling components
- requirements of the assembly in terms of specifications, operational performance, quality and safety
- procedures for lubricating the assembly
- materials
- checks to be undertaken during inspection of the final assembly
- procedures for returning components/assemblies into use
- hazards and control measures associated with dismantling, replacing and assembling engineering components, including housekeeping

**REQUIRED SKILLS AND KNOWLEDGE**

- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to dismantle, replace and assemble engineering components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with dismantling, replacing and assembling engineering components or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not

**EVIDENCE GUIDE**

	require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering components</b>	Includes a range of component parts found in equipment or product assemblies, sub-assemblies, e.g. couplings, universal joints, pumps etc. employing shafts, pre-manufactured bearings and seals, lubricants, fasteners, gaskets etc.
<b>Appropriate tools and equipment</b>	Includes a range of hand and power tools, bearing pullers, special purpose dismantling and assembly tools etc.
<b>Selected</b>	Replacement parts are selected from manufacturers' catalogues, etc.
<b>Appropriate techniques</b>	Are in accordance with standard operating procedures and may include the straightforward removal and replacement of pre-manufactured bearings and seals

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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# MEM18056B Diagnose and repair analog equipment and components

## Modification History

Single band identifier removed to clarify dual status

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating faults in analogue electronic equipment or sub-assemblies, and replacing faulty components.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to electronic systems or equipment including amplifiers, analogue hardware, communication, consumer audio/video, electronic appliances, scanning systems, security/fire systems, power supplies and test equipment etc.</p> <p>All specifications and procedures are gained from schematics, circuit drawings, engineering data sheets or manufacturers' handbooks.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered. Where termination of cables is involved, Unit MEM10002B (Terminate and connect electrical wiring) and/or Unit MEM18063B (Terminate signal and data cables) must also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 10</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM18001C	Use hand tools
	MEM18057B	Maintain/service analog/digital electronic equipment

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault in electronic system/sub-assembly	<ul style="list-style-type: none"><li>1.1. System/sub-assembly functions and principles are determined with reference to equipment manuals, circuit diagrams etc.</li><li>1.2. Built-in test functions are run and fault indicator error codes and appropriate maintenance records are checked and reviewed.</li><li>1.3. Fault symptoms are reproduced, where appropriate, and verified using appropriate fault finding techniques.</li><li>1.4. Where appropriate, faulty sub-assembly is isolated and removed from electronic system using correct and appropriate tools and techniques.</li><li>1.5. Sub-assembly is checked and tested using correct and appropriate test equipment and fault finding techniques.</li><li>1.6. Faulty component/s are identified and/or fault cause is isolated.</li></ul>
2. Repair/replace faulty components	<ul style="list-style-type: none"><li>2.1. Faulty component is removed, where required, using correct and appropriate tools and techniques.</li><li>2.2. Faulty component is repaired/replaced in accordance with manufacturers' recommended procedures or to standard operating procedures.</li><li>2.3. Repaired/replacement components are fitted in accordance with manufacturers' recommended procedure or to standard operating procedures using correct and appropriate tools and techniques.</li><li>2.4. Where appropriate, repaired sub-assembly is refitted to electronic system using correct and appropriate tools and techniques.</li><li>2.5. Systems/sub-assembly is checked and tested for correct operational compliance with specifications utilising correct and appropriate test procedures and equipment.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- obtaining and following relevant circuit diagrams, manuals, specifications, schematics, maintenance records, supplier catalogues, etc.
- locating, reading/recording and diagnosing built-in fault indicators
- obtaining error code interpretation documents
- running test functions and recording faults and/or equipment status indicated by built-in test functions/displays
- checking electronic equipment/sub-assemblies, components, connections and terminations for conformance to specifications
- removing and replacing/repairing faulty components from the electronic equipment
- recording results of tests undertaken on electronic equipment
- isolating electronic sub-assembly from the power supply
- adjusting/tuning and calibrating electronic equipment/sub-assemblies
- returning to service and testing to specification the repaired electronic equipment/sub-assembly
- using language and literacy skills to provide brief reports/records/results of tests
- reproducing fault symptoms in the electronic equipment and verifying faults using appropriate test equipment and fault finding techniques
- refitting repaired/replaced components into the sub-assembly

**Required knowledge**

Look for evidence that confirms knowledge of:

- analogue electronics including amplifiers, oscillators, power suppliers, filters
- the function(s) of the electronic equipment/sub-assembly
- symptoms of the fault in the electronic equipment/sub-assembly
- the purpose of reproducing electronic equipment/sub-assembly fault symptoms
- equipment and techniques to be used to test the faulty sub-assemblies/component
- probable causes of component failure
- procedures for:
  - running built-in test functions
  - verifying faults in electronic equipment/sub-assemblies
  - isolating electronic equipment/sub-assemblies
  - removing sub-assemblies from electronic equipment
  - testing faulty sub-assemblies
  - removing faulty components from electronic equipment
  - fitting repaired/replaced components into sub-assemblies

**REQUIRED SKILLS AND KNOWLEDGE**

- fitting repaired sub-assemblies into electronic equipment
- testing electronic equipment/sub-assembly performance
- errors indicated by built-in devices
- test equipment and fault finding techniques necessary to confirm electronic equipment/sub-assembly faults
- hazards associated with electronic equipment/sub-assemblies including electro-static discharge (ESD)
- tools and techniques to be used to remove/refit/repair/replace the faulty sub-assemblies/component from the electronic equipment
- operational specifications of the sub-assembly
- operational specifications of the electronic equipment/sub-assembly/component
- test equipment and techniques necessary to check electronic equipment/sub-assembly performance
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and repair analog equipment and components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must

<b>EVIDENCE GUIDE</b>	
	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and repairing analog equipment and components, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Fault finding techniques</b>	<p>Signal injection, substitution, monitoring, measurement, heating, sound, visual, touch, smell</p>

<b>RANGE STATEMENT</b>	
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, cathode ray oscilloscopes, frequency counters, signal generators, digital probes
<b>Components</b>	Discrete component assemblies or individual components such as resistors, switching devices, capacitors, transformers, solenoids, tubes, semi-conductors

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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# MEM18057B Maintain/service analog/digital electronic equipment

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers maintaining/servicing analog/digital electronic equipment.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the testing and maintenance of electronic equipment and systems, where a series of checks and pre-determined tests is applied in accordance with workshop manuals, testing procedures etc. Checks, tests and calibrations apply to a wide range of electronic systems and sub-assemblies used in engineering environment including telecommunication, process control, computer systems, security monitoring and alarm systems, etc.</p> <p>This unit also covers the replacement of faulty components identified during these tests.</p> <p>Where termination of cables is involved, Unit MEM10002B (Terminate and connect electrical wiring) and/or Unit MEM18063B (Terminate signal and data cables) must also be selected.</p> <p>If diagnosis and repair of electronic equipment is undertaken to component level, Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Undertake maintenance checks and routine tests	<p>1.1. Electronic equipment, functions are determined and understood by reference to circuit diagrams, equipment manuals and/or consultation with equipment operator where appropriate.</p> <p>1.2. Equipment built-in test functions are run and results are recorded to standard operating procedures where appropriate.</p> <p>1.3. Built-in faults/status display is noted and recorded to standard operating procedures.</p> <p>1.4. Equipment/sub-assemblies, components, connections, terminations etc. are checked visually and with correct and appropriate test equipment and techniques.</p> <p>1.5. Faulty components are removed and replaced where appropriate.</p> <p>1.6. All results are checked for compliance with manufacturers' requirements or specification, and results are recorded to standard operating procedures.</p>
2. Maintain and/or service electronic equipment	<p>2.1. Where appropriate, sub-assemblies are isolated according to standard operating procedures.</p> <p>2.2. Electronic equipment/sub-assemblies are adjusted to specifications, manufacturers' requirements and/or standard operating procedures using correct and appropriate techniques, tools and test equipment.</p>
3. Return electronic equipment to service	<p>3.1. Equipment/sub-assemblies are returned into service utilising correct and appropriate techniques and procedures.</p> <p>3.2. Equipment/sub-assemblies are checked for operational compliance to specifications and/or manufacturers' requirements, and documentation requirements are carried out to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- following relevant circuit diagrams, manuals, specifications, schematics, maintenance records, supplier catalogues etc.
- locating and reading/recording built-in fault indicators
- obtaining error code interpretation documents
- running test functions and recording faults and/or equipment status indicated by built-in test functions/displays
- checking electronic equipment/sub-assemblies, components, connections and terminations for conformance to specifications
- removing and replacing components from the electronic equipment
- isolating electronic sub-assembly from the power supply
- adjusting/tuning and calibrating electronic equipment/sub-assemblies
- returning to service and specification of electronic equipment/sub-assembly
- recording test results

**Required knowledge**

Look for evidence that confirms knowledge of:

- function(s) of the electronic equipment
- electrical principles associated with electronic sub-assemblies
- implications of electro-static discharge (ESD) upon the electronic equipment
- procedures for running built-in test functions
- errors indicated by built-in devices
- procedures for recording faults and/or equipment status identified by built-in test functions/displays
- safe work practices and procedures
- procedures for checking the following for compliance with specifications: electronic equipment/sub-assemblies, components, connections, terminations
- tools and techniques to be used to remove/replace components from/into electronic equipment
- procedures for removing faulty components from electronic equipment
- procedures for fitting replacement components into electronic equipment
- operational specifications of the electronic equipment
- equipment and techniques to be used to test the electronic equipment
- procedures for testing electronic equipment
- procedures for recording electronic equipment test results
- procedures for isolating electronic equipment/sub-assemblies
- electrical hazards associated with electronic sub-assemblies
- procedures, tools, equipment and techniques to be used to adjust/tune and calibrate the electronic equipment/sub-assembly
- operational specifications of the electronic equipment/sub-assembly

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures equipment and techniques to be used to return the electronic equipment/sub-assembly back into service
- procedures for recording/documenting the maintenance servicing of the electronic equipment/sub-assembly
- procedures, test equipment and techniques to be used to check the electronic equipment/sub-assembly for conformance to specification

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain/service analog/digital electronic equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining/servicing analog/digital electronic equipment, or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Electronic equipment**

Amplifiers, analogue/digital hardware, communication, consumer audio/video, electronic appliances, scanning systems, security/fire systems, power supplies and test equipment etc.

**Components**

Discrete component, circuit boards, connectors, plug-in items, power supplies and the like

**Test equipment**

Includes the use of voltmeters, ammeters, cathode ray oscilloscopes, frequency counters, continuity testers etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18058C Modify electronic equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers modifying and recommissioning equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to modifications of electronic equipment including minor adjustments and alteration requirements through to experimental and development modifications of a complex nature and can include replacement and/or alterations of system equipment, sub-assemblies, PCBs and components etc. on analog and digital electronic equipment and systems.</p> <p>Where drafting skills are required, then Unit MEM09003B (Prepare basic engineering drawing) or Unit MEM09004B (Perform electrical/electronic detail drafting) should be considered.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM12004B	Perform precision electrical/electronic measurement
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18056B	Diagnose and repair analog equipment and components
	MEM18065B	Diagnose and repair digital equipment and components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Modify equipment	<p>1.1.Modification requirements are determined and understood by reference to circuit diagrams, schematics, equipment manuals and /or consultation with technical authority where appropriate.</p> <p>1.2.Equipment is isolated to standard operational procedures.</p> <p>1.3.Equipment is removed from system, if required, using correct and appropriate techniques and equipment.</p> <p>1.4.Modification is carried out to equipment/sub-assembly/component in accordance with specifications or application requirements using correct and appropriate techniques and equipment.</p> <p>1.5.Sub-assembly is refitted to equipment, if required, using correct and appropriate techniques and equipment.</p>
2. Return equipment to service	<p>2.1.Where required, circuit diagrams, schematics, equipment manuals etc. are amended to reflect modifications undertaken.</p> <p>2.2.Checks and tests are undertaken to specifications using correct and appropriate techniques, test equipment and tools.</p> <p>2.3.Equipment/system is recommissioned using correct and appropriate techniques and procedures.</p> <p>2.4.Equipment/system is checked for operational compliance with specifications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant circuit diagrams, schematics, manuals
- isolating, tagging and verifying isolated equipment



**REQUIRED SKILLS AND KNOWLEDGE**

- removing and refitting sub-assembly/equipment from the system
- carrying out modifications to specification
- amending circuit diagrams, schematics, equipment manuals, specifications affected by the modifications
- recommissioning electronic equipment
- testing, checking modified electronic equipment to ensure conformance to specifications
- entering routine and familiar information onto proforma and standard workplace forms
- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation

**Required knowledge**

Look for evidence that confirms knowledge of:

- system concept including software/hardware systems, feasibility analysis and circuit analysis
- diagnostic skills and implications relative to the modification
- modification requirements
- sources of technical advice
- procedures for isolating and removing equipment from the system
- specifications applicable to the modification
- permits/approvals required
- tools and equipment necessary to carry out the modification
- specialised fitting requirements
- the electronic equipment specifications
- procedures and test equipment application
- procedures for recommissioning electronic equipment
- operational specification of the equipment/system
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to modify electronic equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying electronic equipment, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Modifications</b>	Minor adjustments and alterations requirement to experimental and development modifications of a complex nature and can include replacement and /or alterations of system equipment, sub-assemblies, PCBs and components on analog and digital electronic systems
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, cathode ray oscilloscopes, frequency counters, signal generators, digital probes etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18059B Modify electronic systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking modifications to electronic system(s) including the testing and evaluating the modified system.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to modifications including approved design changes and/or replacement of components or sub-assemblies on electronic analog and digital systems.</p> <p>Where drafting skills are required, then Unit MEM09003B (Prepare basic engineering drawing) or Unit MEM09004B (Perform electrical/electronic detail drafting) should be considered. Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18056B	Diagnose and repair analog equipment and components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18058C	Modify electronic equipment
	MEM18065B	Diagnose and repair digital equipment and components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine modification	<p>1.1.Modification requirements are determined and understood by reference to schematics, circuit diagrams, documentation and/or consultation with appropriate authority.</p> <p>1.2.Where appropriate, maintenance reports and system output information is analysed to confirm the need and nature of modification.</p> <p>1.3.Scope and nature of modifications are determined, recorded to standard operating procedures and confirmed with appropriate authority.</p>
2. Undertake modification/s	<p>2.1.Modification/s are undertaken using correct and appropriate techniques, tools and procedures.</p> <p>2.2.Correct and appropriate amendments are undertaken to documentations, circuit drawing etc. using standard operating procedures.</p>
3. Test and evaluate modified electronic systems	<p>3.1.Modifications are checked/tested and evaluated for compliance with desired outcome or specification using correct and appropriate techniques, tools and test equipment.</p> <p>3.2.Additional modification changes, if required, are recommended using standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant instructions, schematics, circuit diagrams
- obtaining relevant maintenance reports and system output information

**REQUIRED SKILLS AND KNOWLEDGE**

- recording proposed modifications
- obtaining approval to for the proposed modifications
- modifying electronic systems
- amending relevant documents, circuit drawings, schematics etc.
- checking modified electronic system for conformance to specification
- programming computers including uploading/downloading of proprietary software
- testing and evaluating modified electronic system

**Required knowledge**

Look for evidence that confirms knowledge of:

- advanced analogue and digital electronics theory
- system/computer protocols including communications, networks, intranet, SCADA etc.
- modifications to be made to the electronic system
- reasons for undertaking the modification
- appropriate personnel to consult for technical advice
- hazards associated with the electronic system including electro-static discharge (ESD)
- probable causes for any detected trends and/or deviations from specification
- appropriate authority to authorise modifications to electronic systems and changes to documentation, circuit drawings, schematics etc.
- procedures to be followed when undertaking and recording modifications to electronic systems
- tools and techniques to be used to modify the electronic system
- procedures for amending documents, circuit drawings, schematics etc.
- procedures for checking the performance of the modified electronic system
- test equipment and techniques to be used to evaluate the modified electronic system
- operational specifications to be achieved by the modified electronic system
- deviations/variations of test results from operational specifications
- probable causes of any deviations/variations from specification
- likely effect of further modifications on electronic system performance

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the



<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to modify electronic systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying electronic systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Modification</b>	Approved design changes and /or replacement of components or sub-assemblies on electronic analog or digital systems
<b>System</b>	Interdependent equipment including computer, process, communication, digital, security/fire etc.
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, cathode ray oscilloscopes, frequency counters, signal generators, digital probes etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18060B Maintain, repair control instrumentation - single and multiple loop control systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining control loop characteristics, monitoring and recording the operation of a control loop, localising the fault condition, and replacing or repairing the faulty condition.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to split architecture single/multi loop control instrumentation that includes PLCs, distributed control systems (DCS) and computer-based systems. This unit also includes the basic adjustment of controller modes, checking of the loop operation, identification and fault finding of simple and multiple controller type controls schemes and the adjustment of controller modes.</p> <p>Where fault finding is required to electronic component level, Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should also be selected.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test, calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

Prerequisite units		
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18064B	Maintain instrumentation system components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine control	1.1.Engineering specifications, technical information

ELEMENT	PERFORMANCE CRITERIA
loop operating characteristics	<p>and historical trends are examined for relevant data.</p> <p>1.2. System specifications, operational data and other relevant data sources are examined, read, interpreted and relevant conclusions are noted.</p> <p>1.3. Consultation with system operators and other relevant plant personnel is carried out, and relevant data is extracted and documented by appropriate means.</p> <p>1.4. Using knowledge of all control loop device characteristics, controller mode principles and adjustment methods, operation of the system is observed.</p> <p>1.5. Appropriate test equipment and testing procedures are used.</p> <p>1.6. Fault finding and diagnostic techniques are utilised.</p> <p>1.7. Relevant data is collected by appropriate means from all sources including maintenance records, fault indicators, charts, error codes operational symptoms, observation monitoring and consultation with appropriate personnel.</p>
2. Monitor and record operation of a control loop	<p>2.1. Pneumatic, electrical and electronic circuit diagrams are interpreted and understood.</p> <p>2.2. Using knowledge of all control loop device characteristics, controller mode principles and calibration/adjustment methods, loop operation from the controller response to set point and manual output changes using correct test equipment, principles and procedures are checked, tested and monitored.</p> <p>2.3. Software configuration data for digital control systems is interpreted.</p> <p>2.4. Operational responses are monitored and recorded by appropriate means.</p> <p>2.5. Fault finding and diagnostic techniques are utilised throughout checking and testing procedures including simple and multi-controller type control schemes.</p> <p>2.6. Diagnostic results and conclusions are analysed against predetermined operational specifications.</p>
3. Localise fault condition	<p>3.1. Circuits are tested to the level necessary to identify and localise faults.</p> <p>3.2. Drawings/diagrams and operational testing data are</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>utilised in identifying and localising fault conditions.</p> <p>3.3.Fault condition is localised and verified to major component level using appropriate test equipment, principles and procedures.</p>
4. Replace or repair faulty condition	<p>4.1.Components are dismantled for repair or replacement using appropriate tools, equipment and procedures.</p> <p>4.2.Replaceable items are selected from manufacturers' catalogues, spare parts lists, or data sheets.</p> <p>4.3.Serviceable items are repaired using correct principles, tools, equipment and procedures.</p> <p>4.4.Repaired and replaceable items are reassembled using appropriate tools, equipment, techniques and procedures.</p>
5. Calibrate and adjust control instrumentation	<p>5.1.Panel mounted, split architecture single loop/multiple loop control instruments are calibrated and adjusted using correct calibration principles, equipment and methods for all devices according to manufacturers' instructions.</p> <p>5.2.Adjust controller modes and actions are adjusted according to specifications.</p> <p>5.3.Zero span and range checks are undertaken using correct and appropriate configuration.</p> <p>5.4.Correct and appropriate procedures, techniques, tools and equipment are used to make final adjustments to control instrumentation to specifications.</p>
6. Complete service reports and recommission	<p>6.1.Service reports are completed to standard operating procedures.</p> <p>6.2.Appropriate follow-up procedures are adopted.</p> <p>6.3.Control instrumentation is recommissioned to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.



## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant engineering specifications, technical information, software data, diagrams and drawings, historical records and documents pertaining to the system components and operational data
- consulting system operators and other relevant plant personnel with respect to the control loop characteristics
- confirming function/malfunction of the system and/or its components
- checking operational characteristics of control devices, signal conversion instruments and final control elements for conformance to specification
- identifying faults/defects in control system components
- locating/reading in-built fault indicators and error codes
- obtaining relevant pneumatic, electrical and electronic circuit diagrams
- testing and monitoring the control loop for correct operation
- monitoring and recording responses of the control system
- using appropriate fault-finding and diagnostic techniques and procedures throughout the monitoring and testing process
- comparing collected data with the operational specifications of the control system
- marking components for repair or replacement
- dismantling/disassembling serviceable items
- setting up appropriate test and calibration equipment
- setting and adjusting the controller modes
- checking the control instrumentation for correct zero, span and range
- adjusting the control system as required
- completing all necessary reports including appropriate follow-up procedures
- commissioning the control system
- interpreting trends from operational data
- interpreting information from in-built devices
- calculating control loop characteristics

### Required knowledge

Look for evidence that confirms knowledge of:

- mathematical computations including algebra, exponentials and logarithms, equations, graphs, charts, vectors, complex numbers, Boolean algebra
- relevant data, including information from in-built devices on the control loop characteristics
- specifications of each system component
- control programming
- SCADA systems, programmable logic controller systems (PLC) distributive control systems (DCS) and computer-based systems

## REQUIRED SKILLS AND KNOWLEDGE

- procedures for documenting/reporting information
- signal transmission including the principles of operation of the final control element, procedures for calibrating and adjusting the control system
- correct function of the circuits and components within the control loop
- calibration and adjustment methods for the control loop devices
- configuration of the digital control system software
- operational responses and procedures for monitoring and recording test and operational data
- fault-finding and diagnostic techniques throughout the monitoring and testing process
- deviations/variations from specification
- procedures for documenting control system tests and analysis
- hazards associated with testing circuits
- procedures for isolating and testing the control system and its components
- procedures for verifying apparent faults in circuits and/or control system components
- procedures for marking components for repair or replacement including procedures for dismantling/ disassembling components for repair or replacement
- correct maintenance procedures for serviceable item(s)
- procedures for assembling repaired and/or replacement items
- procedures and equipment necessary for the calibration of control system components
- adjustments which affect the calibration to control system components
- controller modes and actions
- procedures for checking control instruments for zero, span and range
- procedures for making final adjustments to ensure all control system components conform to specification
- reporting/recording requirements associated with the commissioning of the control system
- follow-up actions to be undertaken after maintaining/repairing control system instrumentation
- procedures for commissioning the control system
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

## EVIDENCE GUIDE

performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain, repair control instrumentation - single and multiple loop control systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining, repairing control instrumentation - single and multiple loop control systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

### Guidance information for

## EVIDENCE GUIDE

assessment

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Historical trends

SCADA, charts, chart recorders and data loggers, equipment condition monitoring etc.

#### Control loop

An opened and closed loop system includes final control elements, process measuring devices, converters, controllers, process signals and the like

#### Major components can include

Transducers, power supplies, removable circuit boards, sensor units and other like components

## Unit Sector(s)

Unit sector

## Co-requisite units

Co-requisite units

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18061B Maintain/calibrate complex control systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining system specification and control loop characteristics, and testing, monitoring and recording system operation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to localising the fault condition; repairing or replacing faulty condition; calibrating, configuring and adjusting complex control systems; and recommissioning the system.</p> <p>It extends to the use of pneumatic analog and digital test and recording equipment for the calibration, configuration and testing of multiple loop control systems including pneumatic, analog electronics, distributed PLC and computer-based control systems which include supervisory mode.</p> <p>Work is to be undertaken autonomously or in a team environment in consultation with appropriate personnel, using predetermined standards of quality, safety and workshop procedures.</p> <p>Tasks are to be undertaken in workshop or on-site environments and involve the interpretation of manuals, specifications and diagrams, including pneumatic, electrical, electronic and logic diagrams, as well as program listings and configuration data for control system devices.</p> <p>Control strategies include: ratio, cascade, selector, duplex, feed forward, adaptive, dynamic compensations, computations, energy management and environmental control/systems.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of</p>
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	<p>components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18062B	Install, maintain and calibrate

Prerequisite units		
		instrumentation sensors, transmitters and final control elements
	MEM18069B	Maintain, repair instrumentation process control analysers
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18064B	Maintain instrumentation system components
	MEM18069B	Maintain, repair instrumentation process control analysers
<b>Path 3</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations



Prerequisite units		
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18067B	Tune control loops - multi controller or multi element systems
<b>Path 4</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems

Prerequisite units		
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18064B	Maintain instrumentation system components
	MEM18067B	Tune control loops - multi controller or multi element systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine system specifications and control loop characteristics	<p>1.1.Engineering specifications, technical information and historical records and trends are examined and relevant data is documented.</p> <p>1.2.System specifications and operational data including those for multiple loop control systems and devices are obtained, read and interpreted.</p> <p>1.3.Circuit and logic diagrams and configuration data are</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>obtained, read and interpreted.</p> <p>1.4.Consultation with system operators and other relevant plant personnel is carried out, and relevant data is extracted and documented by appropriate means.</p> <p>1.5.Appropriate work clearances are obtained for monitoring and testing the system.</p>
2. Test, monitor and record system operation	<p>2.1.Relevant data is collected by appropriate means from all sources including maintenance records, chart recorders, data loggers, fault indicators, error codes, operational symptoms, tests and observation monitoring.</p> <p>2.2.Fault detection and diagnostic data are analysed against predetermined operational specifications, and conclusions are documented.</p> <p>2.3.System operation is observed using knowledge of all individual/multiple element loop device characteristics, controller mode principles, testing, calibration and adjustment methods.</p> <p>2.4.Appropriate test equipment is set up and used correctly.</p> <p>2.5.Appropriate tests are undertaken using standard operating procedures.</p> <p>2.6.Signal transmission test equipment is set up and used where applicable.</p> <p>2.7.Adjustment/maintenance needs are determined through interpretation and analysis of pneumatic, electrical, electronic, logic diagrams and configuration data for all control system devices.</p> <p>2.8.Appropriate field instrumentation is connected to test system configuration.</p> <p>2.9.Field instrumentation is connected and tested for selected control operation, and performance is monitored against specifications.</p> <p>2.10. Diagnostics checks are carried out to ensure correct operation.</p> <p>2.11. Fault finding and diagnostic tests are undertaken using correct equipment, techniques and procedures to detect faulty control system components or elements.</p>
3. Localise fault condition	<p>3.1.System is tested to the level necessary to detect and localise fault condition.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>3.2. Fault condition is localised and verified using appropriate test equipment, principles and processes.</p> <p>3.3. Fault condition is analysed, evaluated and corrective action is planned.</p>
4. Replace faulty items or repair faulty condition	<p>4.1. Faulty items are dismantled for repair or replacement using appropriate tools, equipment and procedures according to manufacturers' recommendations.</p> <p>4.2. Replaceable items are selected from manufacturers' catalogues, spare parts lists, or data sheets.</p> <p>4.3. Using manufacturers' handbooks, correct maintenance procedures for faulty items are established.</p> <p>4.4. Faulty items and/or condition are repaired using correct maintenance procedures and equipment.</p> <p>4.5. Repaired and replaceable items are reassembled using appropriate principles, tools, equipment, techniques and test procedures.</p>
5. Calibrate, configure, adjust complex control systems	<p>5.1. Diagnostic checks are carried out to ensure correct operation of system, taking appropriate corrective action as necessary.</p> <p>5.2. Correct calibration and test equipment is selected/set up to enable calibration to manufacturers' specifications.</p> <p>5.3. Mechanical alignment of control devices is undertaken where applicable.</p> <p>5.4. System is configured using appropriate programming tools and techniques.</p> <p>5.5. Relevant alignment procedures are performed for optimum control and in accordance with specifications.</p> <p>5.6. Correct sequence of alignment is used on multiple control loops and multi-element systems.</p> <p>5.7. Correct recording equipment is set up for adjustment and monitoring during alignment.</p> <p>5.8. Calibration and adjustment function are performed on multi-loop devices, multi-element control loops, controller modes and actions according to operational specifications using correct principles and methods applicable to the type of control loop being serviced.</p> <p>5.9. On-line changes are made to parameters in the system to meet specified requirements.</p> <p>5.10. Field instrumentation is connected for</p>

ELEMENT	PERFORMANCE CRITERIA
	selected control operation and system is operated to a satisfactory level of control.
6. Return system to service	<p>6.1.Final adjustments to align system operation to operational specifications including process and optimum control efficiencies are undertaken.</p> <p>6.2.Correct procedures are applied in return to service including configuring, calibrating, adjusting, tuning and final validation of system performance in accordance with specifications.</p> <p>6.3.System is returned to service.</p> <p>6.4.Service reports are completed to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant engineering specifications, technical information, historical records and other reference documents
- obtaining specifications of system components and operational data
- obtaining relevant circuit and logic diagrams and configuration data
- planning and sequencing operations
- checking and clarifying task-related information
- undertake numerical operations, and engineering calculations/formulae within the scope of this unit
- consulting system operators and other relevant plant personnel with respect to the control loop characteristics
- documenting information obtained from system operators and other relevant personnel
- obtaining necessary work clearances for the monitoring and testing of the system
- locating and interpreting in-built fault indicators and error codes
- comparing collated data with the operational specifications of the control system
- documenting results of the analysis of collated data and any conclusions reached
- observing operation of the system confirm function/ malfunction of the system

**REQUIRED SKILLS AND KNOWLEDGE**

and/or its components

- setting up and using test equipment
- performing tests
- measure signals using suitable test equipment and analysis techniques
- connecting field test instruments to the system
- testing and monitoring the operation of selected controls using field test instrumentation
- performing diagnostic checks on the system
- checking operational characteristics of control devices, signal conversion instruments and final control elements for conformance to specification
- testing system using fault finding techniques including continuity testing, fault isolation
- verifying faults
- documenting corrective action
- marking items for repair or replacement
- dismantling and assembling items
- obtaining manufacturers'/suppliers' catalogues, spare parts lists or data sheets
- repairing item(s) using appropriate tools and equipment
- performing diagnostic checks of the system
- taking corrective action to bring system operation into line with specifications
- setting up test and calibration equipment
- aligning control devices to specifications
- configuring the system
- aligning controllers for optimum performance
- aligning multiple control loops in the correct sequence
- setting up and monitoring recording equipment during the tuning process to identify the effects of adjustment made to the system
- calibrating and adjusting control system components
- changing system parameters on-line to meet specified requirements
- connecting field test instrumentation to selected control system
- operating the control system
- adjusting the control system
- validating system performance
- returning control systems to service
- completing reports

**Required knowledge**

Look for evidence that confirms knowledge of:

- the specification of each system component
- relevant data and/or trends

**REQUIRED SKILLS AND KNOWLEDGE**

- system components and their function
- procedures for:
  - documenting information
  - obtaining work clearances
  - documenting control system tests and analysis
  - using test equipment
  - testing system configuration, control system components/elements, testing circuits and control lines
  - testing and monitoring the operation of selected controls
  - carrying out diagnostic checks
  - isolating the control system and its components
  - marking serviceable items for repair or replacement
  - dismantling/disassembling items for repair or replacement
  - servicing item(s)
  - adjusting the system to conform to operational specifications
  - calibrating the control system components
  - aligning control devices
  - configuring the system
  - tuning controllers, multiple control loops and multi-element systems
  - recording signals and data during system tuning operations
  - changing parameters
  - operating and monitoring a control system
  - making final adjustments to ensure all control system components conform to specifications
  - assembling repaired and/or replacement items
  - returning to service
  - reporting/recording requirements associated with return to service of control systems
- reasons for:
  - observing the system in operation
  - selecting the chosen test equipment
  - identifying the adjustments/maintenance to be carried out
  - selecting the chosen diagnostic checks
  - selecting the chosen test and calibration equipment
  - any deviations/variations from specification
- the errors indicated by in-built devices
- deviations/variations from specification
- the following for the given system: all individual/multiple element loop device characteristics; controller mode principles, testing methods; calibration methods;

**REQUIRED SKILLS AND KNOWLEDGE**

- adjustment methods
- equipment:
  - to be used and reasons for selecting the chosen equipment
  - required to verify an apparent fault
  - used to test system configuration
  - required to undertake maintenance on item(s)
  - necessary to calibrate the control system components
  - necessary to carry out the alignment of the control devices
  - programming tools and techniques to be used
  - appropriate measuring techniques, tools and equipment
- adjustments/maintenance to be carried out
- diagnostic checks to be applied to the system to ensure correct operation of the system
- fault finding and performing diagnostic tests to be applied to control devices, signal conversion instruments and final control elements
- hazards associated with testing circuits and control lines
- causes of verified faults and the action to be taken to return the control system/component to specification
- appropriate replacement parts
- specifications of serviceable item(s)
- diagnostic checks to be carried out
- specifications of the equipment to be calibrated
- alignment specifications
- specifications of the controllers
- correct sequence of tuning
- recording equipment to be used
- adjustments that can be made to control system components
- effects of those adjustments on the calibration of the control system components
- requirements to be achieved by changing system parameters on-line
- the level of control to be achieved
- hazards and control measures associated with maintaining/calibrating complex control systems
- use and application of personal protective equipment
- safe work practices and procedures



## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain/calibrate complex control systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining/calibrating complex control systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Control loop**

A process of documenting and recording measurements and variables within the process

**Test equipment**

Engineer level, laser alignments etc., and appropriate equipment for measurement of alignment, flatness, squareness, straightness, temperature, vibration, load deflection, noise level, RPM

**Tests**

Measuring and analysing to ensure correct operation

**Control system**

Control systems include pneumatic control, analog and/or digital electronics, distributed PLC, DCS, SCADA, and computer-based control systems. Computer-based control systems may include supervisory mode

**Field instrumentation**

Test and measuring equipment which could include specialised testing fixtures or equipment

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18062B Install, maintain and calibrate instrumentation sensors, transmitters and final control elements

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting and installing appropriate sensors and signal transmitters, maintaining and diagnosing correct operation of sensors and signal transmitters, and completing fault documentation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to planning corrective action; repairing, replacing and overhauling sensors and signal transmitters; and calibrating, testing, re-installing and recommissioning instrumentation sensors and signal transmitters.</p> <p>Tasks relate to the use of mechanical, electrical, electronic (analog and digital) and associated sensing indications and signal transmitting instrumentation, representing measurement of pressure, temperature, level, flow rate, weight, density and other process variables.</p> <p>It also applies to the maintenance of control valves (including changing and reseating valve plugs); adjustment of valve actuators (pneumatic, electrical and hydraulic); and maintenance and adjustment of pneumatic, electro-pneumatic and electronic valve positioners and signal converters.</p> <p>Tasks are undertaken in workshop, laboratory or on-site environments.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p>If diagnosis and repair of electronic equipment is</p>
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	<p>undertaken to component level, Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components

Prerequisite units		
	MEM18057B	Maintain/service analog/digital electronic equipment
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18064B	Maintain instrumentation system components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Select for installation appropriate sensors, transmitters and final control elements	<p>1.1. Specification requirements are determined from data sheets, circuit diagrams, engineering drawings.</p> <p>1.2. Using knowledge of device characteristics and principles of operation, specification requirements are interpreted, defined and understood.</p> <p>1.3. Having regard for measurement range, processes and environment, sensors, transmitters and final control elements are selected according to their device characteristics, principles of operation and measurement capabilities, in conformance to specifications.</p>
2. Install instrumentation sensors, transmitters and final control elements	<p>2.1. Sensors, transmitters and final control elements are installed using sound working knowledge of installation principles, procedures, techniques, tools and test equipment, according to appropriate codes of practice, standards, safety and legislative requirements.</p> <p>2.2. During installation access for maintenance and mounting connections for power, signal, and process are planned and catered for.</p> <p>2.3. Installed sensors, transmitters and final control elements are diagnosed for correct operation using appropriate test equipment and procedures. Results are assessed against specifications or manufacturers' technical data sheets.</p>
3. Maintain, diagnose correct operation of sensors, transmitters and final control elements	<p>3.1. Using knowledge of device characteristics and principles of operation, preventative maintenance schedules and procedures are applied to maintain sensors, transmitters and final control elements in optimum condition.</p> <p>3.2. Using knowledge of device characteristics and principles of operation, sensing elements are cleaned and serviced to maintain optimum operating condition particularly at the process interface, using correct principles, tools, test equipment, techniques and procedures.</p> <p>3.3. Using appropriate test equipment and procedures, sensors, transmitters and final control elements are diagnosed, within the system or as individual devices, to determine correct operation or malfunction.</p> <p>3.4. Operation of sensors, transmitters and final control</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>elements is monitored and assessed against predetermined specification or manufacturers' technical data.</p> <p>3.5.Using appropriate test equipment/procedures, correct operation of sensors, transmitters and final control elements is checked or fault condition identified, localised and monitored.</p>
<p>4. Complete fault documentation and plan corrective action</p>	<p>4.1.Faults and malfunctions are documented and/or reported according to standard operating procedures.</p> <p>4.2.Corrective action is planned autonomously or in consultation with appropriate personnel and actioned.</p>
<p>5. Analyse control loop and localise faults</p>	<p>5.1.Engineering specifications and technical information, control device, signal transmission and final element specifications are obtained and interpreted. System specifications, including operational data, and historical records and trends are read and interpreted.</p> <p>5.2.Consultation with system operators and other relevant plant personnel is carried out, relevant data is extracted and documented to standard operating procedures.</p> <p>5.3.Operation of the system is observed using sound knowledge of all external control device characteristics, controller modes, signal transmission, final control devices.</p> <p>5.4.Correct and appropriate signal transmission test equipment is set up and applied using appropriate technique.</p> <p>5.5.Circuits and control lines are tested to the level necessary to detect and localise fault.</p>
<p>6. Repair/replace, overhaul sensors, transmitters and final control elements</p>	<p>6.1.Sensors, transmitters and final control elements are examined and verified for replacement, repair or overhaul using correct tools/test equipment and appropriate principles, techniques and procedures.</p> <p>6.2.Replacement items are selected from manufacturers' parts lists or catalogues to meet specifications.</p> <p>6.3.Replacement items are obtained.</p> <p>6.4.Faulty items are repaired or overhauled using correct principles, techniques, tools, test equipment and procedures.</p> <p>6.5.Repaired, overhauled and replacement items are prepared for refitting according to standard</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>workshop procedures.</p> <p>6.6.Sensors, transmitters and final control elements are refitted using correct principles, tools, test equipment and procedures.</p> <p>6.7.Refitted sensors, transmitters and final control elements are prepared for testing and calibration.</p>
<p>7. Calibrate and test instrumentation sensors, transmitters and final control elements</p>	<p>7.1.Sensors, transmitters and final control elements are calibrated against appropriate physical standards using correct calibration devices, test equipment, techniques and procedures.</p> <p>7.2.Zero, span and range tests are performed using correct calibration devices, test equipment, principles, techniques and procedures.</p> <p>7.3.Zero span and range results are assessed against manufacturers' instructions sheets.</p> <p>7.4.Zero, span adjustments are applied to align sensors, transmitters and final control elements to manufacturers' instruction sheets using correct calibration equipment, principles, techniques and procedures.</p>
<p>8. Return sensors, transmitters and final control elements and control loops to service</p>	<p>8.1.Sensors, transmitters and final control elements are put into service on conformance to specifications with due regard to process requirements, safety, installation/commissioning procedures and sequence of operation.</p> <p>8.2.Controller modes and actions are adjusted according to specifications.</p> <p>8.3.Electrical and pneumatic transmission lines are tested and appropriate action is taken including the use of signal conditioning devices.</p> <p>8.4.Correct procedures are applied in returning instrumentation to service, including configuring, calibrating, adjusting, tuning and validating system performance.</p> <p>8.5.System is returned to service in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- accessing relevant data sheets, circuit diagrams, engineering drawings, instructions, specifications, information and supplier catalogues and replacement components
- selecting sensors, transmitters and final control elements
- installing and testing sensors, transmitters and final control elements to specification
- obtaining and performing relevant scheduled/preventative maintenance schedules for sensors, transmitters and final control elements
- determining correct function of sensors, transmitters and final control elements
- recording test results
- identifying, localising, monitoring and reporting/recording faults in sensors, transmitters and final control elements
- preparing sequential action plan to correct faults in sensors, transmitters and final control elements
- applying procedures to sequential and loop testing
- checking sensors, transmitters and final control elements and marking for replacement, repair or overhaul
- repairing/overhauling faulty items for fitting and /or refitting
- fitting/ refitting sensors, transmitters and final control elements
- preparing fitted/refitted sensors, transmitters and final control elements for testing and calibration
- configuring, calibrating, testing, adjusting, tuning and validating system performance

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics, specifications and principles of operation of the sensors, transmitters and final control elements to be installed
- criteria for selecting sensors, transmitters and final control elements
- procedures for testing, installing and maintaining sensors, transmitters and final control elements and for reporting/recording and monitoring faults and/or malfunctions in sensors, transmitters and final control elements
- factors that determine the type of test equipment required
- tools, equipment and techniques required to install sensors and transmitters
- relevant codes, standards, safety and legislative requirements
- connections to be made to sensors, transmitters and final control elements

## REQUIRED SKILLS AND KNOWLEDGE

- variations of test results from specifications and probable causes of variations between test results and specifications
- housekeeping requirements with respect to sensors.
- test equipment and techniques required to determine correct function or malfunction of sensors, transmitters and final control elements
- probable causes of variations between test results and specifications
- the need for systematic and/or sequential testing
- procedures for configuring, calibrating, testing, adjusting, tuning and validating system performance including sensors, transmitters and final control elements
- physical standards against which sensors, transmitters and final control elements are to be calibrated
- devices, equipment and techniques required to calibrate sensors, transmitters and final control elements
- zero, span and range tests to be applied to the sensors, transmitters and final control elements
- procedures for recommissioning sensors, transmitters and final control elements
- safety procedures to be taken when recommissioning sensors, transmitters and final control elements

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to install, maintain and calibrate instrumentation sensors, transmitters and final control elements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where

## EVIDENCE GUIDE

	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing, maintaining and calibrating instrumentation sensors, transmitters and final control elements, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Final control elements</b>	<p>High level tolerances which include:</p> <ul style="list-style-type: none"> <li>• proportional</li> <li>• integrated differential (PID)</li> <li>• supervisory control and data acquisition (SCADA)</li> <li>• distributive control system (DCS)</li> </ul>
<b>Test equipment</b>	<p>Manometers, dead weight testers, vacuum system, power supplies, control valve test beds, pneumatic, analogue, digital, test and calibration equipment, utilised for maintenance, calibration and testing of process signal converters and final control elements</p>
<b>Control loop</b>	<p>A feedback system responding to analogue or digital configuration data via programmable logic controllers (PLCs), DCS, computer-based systems etc. from the controller response to set points and manual output changes</p>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18063B Terminate signal and data cables

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers terminating signal and data cables. This unit also covers fixing, securing, identifying and marking conductors and cables.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installing all types of signal and data cables, excluding specialist cables.</p> <p>All specifications and procedures are obtained from circuit drawings, data sheets and instructions.</p> <p>If termination of cables is undertaken to pre-determined specifications and procedures, the competency is covered by Unit MEM03004B (Perform electronic/electrical assembly [production]).</p> <p>Where hand held power tools are used, Unit MEM18002B (Use power tool/hand held operations) should also be selected.</p> <p>Where higher levels of electrical/electronic measures are required, Unit MEM12004B (Perform precision electrical/electronic measurement) should be selected.</p> <p>For termination and connection of specialist cables, see Unit MEM10011B (Terminate and connect specialist cables).</p> <p>For termination and connection of other cables, see Unit MEM10002B (Terminate and connect electrical wiring).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify and mark conductors/cables	1.1.Cables and conductors are identified using appropriate test equipment and techniques. 1.2.Cables and conductors are labelled in accordance with standard operating procedures, legislative requirements and statutory regulations to specifications.
2. Prepare cable	2.1.Termination requirements and specifications are obtained and understood. 2.2.Cable ends are prepared to specifications, legislative requirements and statutory regulations utilising appropriate tools and techniques.
3. Terminate cables	3.1.Cables are terminated to specifications utilising appropriate tools and techniques. 3.2.Terminations are tested/examined for compliance with specifications, legislative requirements and statutory regulations utilising appropriate test equipment and techniques.
4. Fix/secure cables	4.1.Cables are fixed/secured in accordance with standard operating procedures, specifications, legislative requirements and statutory regulations, utilising appropriate fixing/securing techniques.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying cables and conductors
- labelling cables and conductors
- obtaining relevant instructions, specifications and data sheets
- preparing cable ends for termination
- following specifications
- testing completed terminations for compliance to specifications
- fixing/securing cables

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- legislative requirements and statutory regulations including ACA Technical Standards AS/ACIF008, AS/ACIF009, SAA Communications Cabling Manual (Open), AS/NZS 3000, Telecommunications Act 1997
- the test equipment and techniques to be used to identify cables and conductors
- procedures to be followed when identifying cables and conductors
- labelling requirements of cables and conductors
- procedures for labelling cables and conductors
- termination requirements and specifications
- procedures, tools and techniques for preparing and terminating cables
- procedures for testing cables and terminations
- factors that influence selection of fixing/securing techniques
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to terminate signal and data cables. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with terminating signal and data cables, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative requirements and statutory regulations</b>	<ul style="list-style-type: none"> <li>• ACA Technical Standards AS/ACIF008, AS/ACIF009</li> <li>• SAA Communications Cabling Manual (Open)</li> <li>• AS/NZS 3000</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Telecommunications Act 1997</li> </ul>
<b>Types of cables</b>	<ul style="list-style-type: none"> <li>• Thermocouple/compensator cables including MIMS</li> <li>• Transmission cables</li> <li>• Thermoplastic/elastomer insulated/sheathed</li> <li>• Compensating cables</li> <li>• Coaxial</li> <li>• Telephone</li> <li>• Category 5</li> <li>• Optical fibre</li> <li>• Extra low voltage control cables</li> </ul>
<b>Terminations</b>	Crimp, wire wrap, (non-insulated and pre-insulated), solder, connectors, multi-terminal plugs and sockets, fibre optics, coaxial, terminal blocks
<b>Fixing and securing</b>	The use of clamps, cable ties, bolting, screwing

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18064B Maintain instrumentation system components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers maintaining instrument system components of a primarily mechanical nature. An understanding of instrumentation principles is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to maintaining instrument system components for applications such as fixed and mobile plant and equipment, marine installations or machine and process operations.</p> <p>Application of this unit would involve identifying instrumentation system components as well as inspecting and assessing component condition/operation using instrumentation principles and methods.</p> <p>It would also involve the interpretation of information from data sheets and circuit diagrams in order to make repairs and replacements to predetermined site or manufacturer specifications.</p> <p>For straightforward removals/replacement of components from an instrumentation system, see Unit MEM18055B (Dismantle, replace and assemble engineering components).</p> <p>If higher level hydraulic and pneumatic systems knowledge is needed then Units MEM18018C (Maintain pneumatic system components ) and MEM18020B (Maintain hydraulic system components ) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Check instrumentation system components	1.1. System components are identified correctly. 1.2. The characteristics and operational function of each system component are understood. 1.3. The operational function of each component is inspected and tested in accordance with standard operating procedures. 1.4. Operation of each component is assessed against specifications.
2. Identify, repair/replace faulty instrumentation system components	2.1. Faulty system components are localised/isolated and the malfunction is confirmed by inspection and testing using instrumentation principles, procedures and safety requirements. 2.2. Faulty system components are dismantled and repaired according to manufacturers'/site specifications and in accordance with standard operating procedures. 2.3. Replacement parts are selected from manufacturer catalogues and listings to required specifications. 2.4. System components are reassembled and tested for correct operation and assessment against specifications and in accordance with standard operating procedures. 2.5. Correct operation of the instrumentation system is confirmed according to standard operating procedures. 2.6. Appropriate follow-up procedures are adopted according to standard operating procedures. 2.7. Where appropriate, service reports are completed according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills



**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- obtaining relevant data with respect to the operation of the instrumentation systems/equipment
- locating, inspecting and testing a range of instrumentation system components
- isolating instrumentation system/equipment
- obtaining and interpreting all relevant instrumentation circuits, drawings, instructions, manuals and data sheets
- checking the individual components within the instrumentation system for correct operation
- dismantling/repairing/reassembling faulty components
- selecting correct replacement parts from the manufacturer/supplier catalogues
- checking repaired/replaced instrumentation system components for correct operation
- completing service reports
- obtaining error code interpretation documents
- recording/documenting test results
- undertaking zero, span and range checks on instrumentation systems/equipment
- calibrating instrumentation system/equipment

**Required knowledge**

Look for evidence that confirms knowledge of:

- instrumentation principles such as controlling density, level, flow, temperature, composition of a range of materials
- effects of resistance, capacitance, inductance and impedance (R,L,C) upon electrical circuit
- interpretation requirements of schematic, wiring and block diagrams and circuits
- basic principles of hydraulic/pneumatic/electrical flow
- purpose and operational function of each system component
- procedures and equipment for inspecting and testing instrumentation system components
- instrumentation system component specifications
- deviations from specifications
- procedures for repairing faulty instrumentation system components
- dismantling, reassembly and testing techniques
- correct operation of the instrumentation system
- procedures for recording and completing service reports
- safe work practices and procedures
- relevant hazards and control measures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain instrumentation system components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining instrumentation system components, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
Components	<p>Include sensors, transmitters, converters, indicators, analysers, controllers, transducers, power supplies, removable circuit boards and sensor units associated with determining/controlling density, level, flow, temperature, composition etc. of a range of materials</p>

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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# MEM18065B Diagnose and repair digital equipment and components

## Modification History

Single band identifier removed to clarify dual status

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating faults in digital electronic equipment or sub-assemblies and replacing faulty components.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to diagnosis and repack of electronic sub-assemblies that can form part of electronic systems or equipment including digital hardware, communication, consumer audio/video, electronic appliances, scanning systems, security/fire systems, power supplies and test equipment etc.</p> <p>All specifications and procedures are gained from schematics, circuit drawings, engineering data sheets or manufacturers' handbooks.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p>Where termination of cables is involved Unit MEM10002B (Terminate and connect electrical wiring) and/or Unit MEM18063B (Terminate signal and data cables) must also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p>
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	<b>Unit Weight: 10</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM18001C	Use hand tools
	MEM18057B	Maintain/service analog/digital electronic equipment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate fault	<ul style="list-style-type: none"><li>1.1. System/equipment functions and principles are determined and understood by reference to equipment manuals, circuit diagrams etc.</li><li>1.2. Built-in test functions are run, and fault indicators error codes and appropriate maintenance records are checked and reviewed.</li><li>1.3. Fault symptoms are reproduced where appropriate and verified, using appropriate fault finding techniques.</li><li>1.4. Where appropriate, faulty equipment is isolated and removed from system using correct and appropriate tools and techniques.</li><li>1.5. Equipment is checked and tested using correct and appropriate test equipment and fault finding techniques.</li><li>1.6. Faulty component/s are identified and/or fault cause is isolated.</li></ul>
2. Repair/replace faulty components	<ul style="list-style-type: none"><li>2.1. Faulty component is removed where required using correct and appropriate tools and techniques.</li><li>2.2. Faulty component is repaired/replaced in accordance with manufacturers' recommended procedures or to standard operating procedures.</li><li>2.3. Repaired/replacement components are fitted in accordance with manufacturers' recommended procedure or to standard operating procedures using correct and appropriate tools and techniques.</li><li>2.4. Where appropriate, repaired equipment is refitted to system using correct and appropriate tools and techniques.</li><li>2.5. Systems/equipment is checked and tested for correct operational compliance to specifications utilising correct and appropriate test procedures and equipment.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant circuit diagrams, manuals, schematics, specifications, maintenance records, supplier catalogues
- locating, reading/recording and diagnosing built-in fault indicators
- obtaining error code interpretation documents
- running test functions and recording faults and/or equipment status indicated by built-in test functions/displays
- checking electronic equipment/sub-assemblies, components, connections and terminations for conformance to specifications
- removing and replacing/repairing faulty components from the electronic equipment
- recording results tests on electronic equipment
- isolating electronic sub-assembly from the power supply
- adjusting/tuning and calibrating electronic equipment/sub-assemblies
- returning to service and testing to specification the repaired electronic equipment/sub-assembly
- reporting/recording return to service
- reproducing fault symptoms in the electronic equipment and verifying faults using appropriate test equipment and fault finding techniques
- refitting repaired/replaced components into the sub-assembly

#### Required knowledge

Look for evidence that confirms knowledge of:

- analogue and digital electronics including amplifiers, oscillators, power suppliers, filters, transistors, ICs, digital timers, gate arrays, transmitters, converters
- the function(s) of the electronic equipment/sub-assembly
- procedures for running built-in test functions
- errors indicated by built-in devices
- symptoms of the fault in the electronic equipment/sub-assembly
- the purpose of reproducing electronic equipment/sub-assembly fault symptoms
- test equipment and techniques necessary to confirm electronic equipment/sub-assembly faults
- procedures for verifying faults in electronic equipment/sub-assemblies
- procedures for isolating electronic equipment/sub-assemblies
- hazards associated with electronic equipment/sub-assemblies including electro-static discharge (ESD)
- procedures for removing sub-assemblies from electronic equipment



**REQUIRED SKILLS AND KNOWLEDGE**

- tools and techniques to be used to remove/refit/repair/replace the faulty sub-assemblies/component from the electronic equipment
- procedures for testing faulty sub-assemblies
- operational specifications of the sub-assembly
- equipment and techniques to be used to test the faulty sub-assemblies/component
- probable causes of component failure
- procedures for removing faulty components from electronic equipment
- procedures for repairing/replacing faulty components
- procedures for fitting repaired/replaced components into sub-assemblies
- procedures for fitting repaired sub-assemblies into electronic equipment
- procedures for testing electronic equipment/sub-assembly performance
- operational specifications of the electronic equipment/sub-assembly/component
- test equipment and techniques necessary to check electronic equipment/sub-assembly performance
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and repair digital equipment and components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

<b>EVIDENCE GUIDE</b>	
	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and repairing digital equipment and components, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Equipment</b>	<p>Digital hardware, communication, consumer audio/video, electronic appliances, scanning systems, security/fire systems, power supplies and test equipment, etc.</p>

RANGE STATEMENT	
<b>Fault finding techniques</b>	Signal injection, substitution, monitoring, measurement, heating/cooling, sound, visual, touch, smell and the use of inbuilt software and hardware diagnostics
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, cathode ray oscilloscopes, frequency counters, signal generators, digital probes etc.
<b>Components</b>	Discrete component assemblies or individual components such as resistors, switching devices, capacitors, transformers, solenoids, tubes, semi-conductors, transistors, ICs, digital timers, gate arrays, transmitters, converters etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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# MEM18066B Diagnose and repair microprocessor-based equipment

## Modification History

Single band identifier removed to clarify dual status

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers locating, replacing/repairing faulty components in microprocessor-based equipment.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to situations in which the individual has sufficient information and access to microprocessor components to diagnose the functioning of elements within the microprocessor.</p> <p>This unit requires understanding of machine and assembly language and address and bus systems. All specifications and procedures are gained from schematics, circuit drawings, instruction sets, flow charts and data sheets.</p> <p>For routine fault finding within microprocessor systems, refer to Unit MEM18057B (Maintain/service analog/digital electronic equipment). For diagnosis of analog components, Unit MEM18056B (Diagnose and repair analog equipment and components) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18065B	Diagnose and repair digital equipment and components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Locate faults	<p>1.1. Equipment function and principles are determined and understood by reference to schematics, circuit diagrams, flow charts, equipment manuals etc.</p> <p>1.2. Built-in test functions are run and results are interpreted correctly.</p> <p>1.3. Fault symptoms are reproduced where appropriate and verified using appropriate fault finding techniques.</p> <p>1.4. Faulty or defect component/s are identified and/or fault cause is isolated using appropriate test equipment.</p>
2. Replace/repair faulty components	<p>2.1. Faulty component is renewed using/ correct and appropriate tools and techniques.</p> <p>2.2. Faulty component/s are repaired/replaced in accordance with manufacturers' recommended procedure or standard operating procedure.</p> <p>2.3. Repaired/replaced component/s are fitted using correct and appropriate tools and techniques.</p> <p>2.4. Equipment is checked and tested for operational compliance to specifications utilising correct and appropriate test procedures and equipment.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining relevant circuit diagrams, manuals, specifications, schematics, maintenance records, supplier catalogues
- locating, reading/recording and diagnosing built-in fault indicators
- obtaining error code interpretation documents
- running test functions and recording faults and/or equipment status indicated by built-in test functions/displays

**REQUIRED SKILLS AND KNOWLEDGE**

- checking microprocessor-based equipment, electronic equipment/sub-assemblies, components, connections and terminations for conformance to specifications
- removing and replacing/repairing faulty components and/or microprocessor from the electronic equipment
- recording results tests undertaken on the microprocessor-based equipment
- isolating the microprocessor-based equipment from the power supply
- adjusting/tuning and calibrating the microprocessor-based equipment
- returning to service and testing to specification the repaired microprocessor-based equipment
- reporting/recording return to service
- reproducing fault symptoms in the microprocessor-based equipment and verifying faults using appropriate test equipment and fault finding techniques
- refitting repaired/replaced components into the microprocessor-based equipment

**Required knowledge**

Look for evidence that confirms knowledge of:

- microprocessor systems, architecture, circuits and dedicated chips
- function(s) of the microprocessor-based equipment
- electronic principles utilised in the operation of the microprocessor-based equipment
- procedures for running built-in test functions
- errors indicated by built-in devices
- symptoms of the fault in the microprocessor-based equipment
- purpose of reproducing fault symptoms
- test equipment and fault finding techniques necessary to confirm microprocessor-based equipment faults
- procedures for verifying faults in microprocessor-based equipment
- procedures for testing faulty microprocessor-based equipment
- hazards associated with microprocessor-based equipment including electro-static discharge (ESD)
- equipment and techniques to be used to test the faulty microprocessor-based equipment
- probable causes of component failure
- procedures, tools and techniques for removing and/or repairing faulty components from microprocessor-based equipment
- reasons for identifying the faulty component for repair or replacement
- procedures, tools and techniques for refitting repaired/ replaced components into the microprocessor-based equipment
- procedures for testing microprocessor-based equipment performance
- operational specifications of the microprocessor-based equipment
- test equipment and fault finding techniques necessary to check the

**REQUIRED SKILLS AND KNOWLEDGE**

microprocessor-based equipment performance

- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose and repair microprocessor-based equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and repairing microprocessor-based equipment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples



**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Equipment</b>	Digital hardware, sub-assemblies of systems or discrete equipment used in computer, communication, consumer audio/video, electronic appliances, scanning systems, security/fire systems, power supplies and test equipment etc.
<b>Fault finding techniques</b>	Include signal injection, substitution, monitoring, measurement, heating/cooling, sound, visual, touch, smell and the use of inbuilt software and hardware diagnostics
<b>Component/s</b>	Discrete component assemblies or individual components such as resistors, switching devices, capacitors, transformers, solenoids, tubes, semi-conductors, transistors, ICs, digital timers, gate arrays, transmitters, converters and microprocessors
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, cathode ray oscilloscopes, frequency counters, signal

**RANGE STATEMENT**

	generators, pulse generators, computer and computer software, data analysers and digital probes etc.
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18067B Tune control loops - multi controller or multi element systems

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining and recording control loop characteristics, tuning control loops and completing service records.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to pneumatic, analog and digital electronic test and recording equipment for the monitoring and adjustment of control loop tuning - the recording of control loop responses in open and closed loop modes.</p> <p>Included is the application of step response - open loop tuning calculations and closed loop ultimate sensitivity trials to achieve specified loop characteristics in conformance to operational specifications.</p> <p>Where fault finding is required to electronic component level, Unit MEM18056B (Diagnose and repair analog equipment and components) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

Prerequisite units		
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18064B	Maintain instrumentation system components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine control loop characteristics	<ul style="list-style-type: none"><li>1.1.Engineering specifications, technical information and historical process, records and trends are examined for relevant data.</li><li>1.2.Consultation with system operators and other relevant plant personnel is carried out, and relevant data is extracted and documented to standard operating procedures.</li><li>1.3.Programmed maintenance/service reports are read and relevant data noted.</li><li>1.4.Data is analysed and control loop characteristics are ascertained.</li></ul>
2. Record control loop responses	<ul style="list-style-type: none"><li>2.1.Using chart recorders and data loggers, control loop responses are recorded in open and closed loop mode.</li><li>2.2.Unit is tested for tuning using appropriate diagnostic techniques.</li><li>2.3.Diagnostic results are analysed against specifications.</li></ul>
3. Tune control loops	<ul style="list-style-type: none"><li>3.1.Using knowledge of control loop device characteristics, controller mode principles and adjustment methods, tuning operations are performed using correct and appropriate techniques, procedures and equipment.</li><li>3.2.Recording equipment used for monitoring and adjustment of control loop components during controller tuning operations is corrected and tested.</li><li>3.3.Step response - open loop tuning calculations are applied to achieve specified loop characteristics.</li><li>3.4.Closed loop tuning methods using ultimate sensitivity and systematic trials are used to achieve specified loop characteristics.</li><li>3.5.Correct sequence of tuning is used on multi controllers and/or multi element systems to achieve specified characteristics.</li><li>3.6.Control loops are tuned to optimum mode settings utilising correct and appropriate techniques, tools, test equipment and procedures.</li></ul>
4. Complete service reports	<ul style="list-style-type: none"><li>4.1.Service reports are completed to standard operating procedures.</li><li>4.2.Appropriate follow up procedures are adopted.</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	4.3.Process control loop is recommissioned to specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- calculating control loop characteristics
- obtaining and interpreting relevant engineering specifications, technical information, software data, diagrams and drawings, historical records and documents pertaining to the system components and operational data
- consulting system operators and other relevant plant personnel with respect to the control loop characteristics
- confirming function/malfunction of the system and/or its components
- checking operational characteristics of control devices, signal conversion instruments and final control elements for conformance to specification
- identifying faults/defects in control system components
- locating/reading in-built fault indicators and error codes
- obtaining relevant pneumatic, electrical and electronic circuit diagrams
- determining corrective action and interpreting trends from operational data
- testing/monitoring the control loop for correct operation
- monitoring and recording operational responses of the control system/loop
- using appropriate fault-finding and diagnostic techniques and procedures throughout the monitoring and testing process
- comparing collected data with the operational specifications of the control system
- marking components for repair or replacement
- dismantling/disassembling serviceable items
- setting up appropriate test and calibration equipment
- setting and adjusting the controller modes
- checking the control instrumentation for correct zero, span and range
- adjusting the control system as required
- implementing diagnostic techniques and procedures
- tuning the control loop
- completing all necessary reports including appropriate follow up procedures

## REQUIRED SKILLS AND KNOWLEDGE

- commissioning the control system

### Required knowledge

Look for evidence that confirms knowledge of:

- proportional integral differential (PID) control loops tuning/calibration techniques
- mathematical computations including algebra, exponentials and logarithms, equations, graphs, charts, vectors, complex numbers, Boolean algebra
- relevant data, including information from in-built devices on the control loop characteristics
- specifications of each system component
- control programming
- SCADA systems, programmable logic controller systems (PLC), distributive control systems (DCS) and computer-based systems
- procedures for documenting/reporting information
- signal transmission including the principles of operation of the final control element, procedures for calibrating and adjusting the control system
- correct function of the circuits and components within the control loop
- calibration and adjustment methods for the control loop devices
- configuration of the digital control system software
- operational responses and procedures for monitoring and recording test and operational data
- fault-finding and diagnostic techniques throughout the monitoring and testing process
- deviations/variations from specification
- procedures for documenting control system tests and analysis
- hazards associated with testing circuits
- procedures for isolating and testing the control system and its components
- procedures for verifying apparent faults in circuits and/or control system components
- procedures for marking components for repair or replacement including procedures for dismantling/ disassembling components for repair or replacement
- correct maintenance procedures for serviceable item(s)
- procedures for assembling repaired and/or replacement items
- procedures and equipment necessary for the calibration of control system components
- adjustments which affect the calibration to control system components
- controller modes and actions
- procedures for checking control instruments for zero, span and range
- procedures for making final adjustments to ensure all control system components conform to specification
- reporting/recording requirements associated with the commissioning of the control



**REQUIRED SKILLS AND KNOWLEDGE**

- system
- follow-up actions to be undertaken after maintaining/repairing control system instrumentation
- procedures for commissioning the control system
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to tune control loops - multi controller or multi element systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with tuning control loops - multi controller or multi element systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

EVIDENCE GUIDE	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Historical process</b>	SCADA, charts, chart recorders and data loggers, equipment condition monitoring etc.
<b>Control loop</b>	An opened and closed loop system includes final control elements, process measuring devices, converters, controllers, process signals and the like
<b>Test equipment</b>	Pneumatic, analogue and digital electronic test equipment for the monitoring and adjustment of control loop tuning

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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# MEM18069B Maintain, repair instrumentation process control analysers

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing preventative maintenance on process control analysers; completing fault documentation; planning corrective action; repairing, replacing, overhauling, calibrating and testing; re-installing and recommissioning process control analysers.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the use of electrical and electronic test equipment for transmission and signal measurement, and extends to the use of liquid analysis devices for the measurement of pH, selective ions, oxygen and electrolytic conductivity.</p> <p>Included is the use of gas analysis devices operating on the principles of thermal conductivity, thermal reaction, combustion, paramagnetism, chemical absorption, ionisation, infra-red, ultraviolet, emission or absorption and solid electrolytic conductivity.</p> <p>Tasks involve the use of hygrometers, wet and dry bulb and calibration of gas cylinders and gas supply equipment, the use of chemical calibration solutions and the use of special calibration devices specific to chemical detectors. Central to the task is the interpretation of electrical and electronic circuit diagrams and the interpretation of calibration and analysis data and procedures in accordance with manufacturers' data sheets. Safety codes of practice including the identification, handling and appropriate use of high pressure gas cylinders, equipment and chemical solutions are included.</p> <p>Work is undertaken autonomously or in a team environment, using predetermined standards of quality, safety and workshop procedures. Tasks are performed in</p>
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	<p>laboratory, workshop or on-site environments.</p> <p>Unit MEM05002B (Perform high reliability soldering and desoldering) must also be selected if soldering of components is required to advanced or military specifications, where the reliability of electrical connections is critical, or where surface mounted devices are being soldered/de-soldered.</p> <p>If diagnosis and repair of electronic equipment is undertaken to component level Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should be selected.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and

Prerequisite units		
		equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18064B	Maintain instrumentation system components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform preventative maintenance on process control analysers	<p>1.1.Specification requirements are determined from manufacturers' manuals, maintenance schedules and other relevant documents.</p> <p>1.2.Using knowledge of process control analyser characteristics and principles of operation, specification requirements are interpreted, defined and understood.</p> <p>1.3.Preventative maintenance schedules are performed on process control analysers to service and maintain analysers within defined specifications.</p> <p>1.4.Using appropriate electrical and electronic test equipment, techniques and procedures, specified process control analysers are diagnosed within the system or within the laboratory to determine correct operation or malfunction.</p> <p>1.5.Operation of process control analysers are monitored and assessed against predetermined laboratory data and/or the fault condition is identified, localised and monitored.</p> <p>1.6.Using appropriate test equipment and procedures, correct operation of analysers is tested, and/or the fault condition is identified, localised and monitored.</p> <p>1.7.Correct operation is confirmed.</p> <p>1.8.Faults and malfunctions are identified and confirmed.</p>
2. Complete fault documentation	2.1.Faults and malfunctions are documented or reported according to standard operating procedures.
3. Plan corrective action	3.1.Corrective action is planned autonomously or in consultation with appropriate personnel and actioned.

ELEMENT	PERFORMANCE CRITERIA
4. Repair, replace, overhaul process control analysers	<p>4.1.Process control analysers are examined or verified for repair, replacement or overhaul using correct tools/equipment and appropriate principles, techniques and procedures.</p> <p>4.2.Replacement items are selected from manufacturers' parts lists or catalogues according to specifications required.</p> <p>4.3.Faulty items are repaired or overhauled using correct principles, techniques, tools, equipment and procedures.</p> <p>4.4.Repaired, overhauled and replacement items are prepared for refitting according to standard operating procedures.</p> <p>4.5.Process control analysers are refitted using correct principles, tools, equipment and procedures.</p> <p>4.6.Refitted process control analysers are prepared for testing and calibration.</p>
5. Calibrate and test process control analysers	<p>5.1.Process control analysers are calibrated against appropriate physical standards using correct calibration devices, equipment, techniques and procedures.</p> <p>5.2.Calibrated process control analysers are tested using appropriate test equipment.</p> <p>5.3.Calibration and analysis data is collected.</p> <p>5.4.Calibration and analysis data is interpreted.</p> <p>5.5.Calibration and analysis data is assessed in accordance with manufacturers' data sheets, codes of practice and safety procedures.</p>
6. Re-install and recommission process control analysers	<p>6.1.Process control analysers are put into service to specifications with due regard to process requirements, codes of practice, safety, commissioning procedures and techniques.</p> <p>6.2.Service reports are completed to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE



**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- obtaining and interpreting relevant data sheets, circuit diagrams, engineering drawings, instructions, manufacturers' manuals, maintenance schedules, supplier catalogues, standard workplace procedures and other reference documents
- performing scheduled/preventative maintenance on process control analysers
- determining correct function or the malfunction of process control analysers
- recording test results
- monitoring apparent faults
- identifying, monitoring and localising faults in process control analysers using a structured diagnostic approach
- confirming correct action of process control analysers
- recording/reporting faults and malfunctions in process control analysers
- preparing sequential action plan to correct faults in process control analysers
- checking and marking process control analysers for replacement, repair or overhaul
- repairing and overhauling faulty items
- preparing repaired, overhauled and replacement items for fitting/refitting
- fitting/refitting process control analysers
- preparing process control analysers for testing and calibration
- calibrating process control analysers against appropriate physical standards using appropriate calibration devices, equipment and techniques
- testing calibrated process control analysers using appropriate equipment
- obtaining relevant calibration and analysis data with respect to the given process controller
- recommissioning process control analysers
- completing necessary service reports

**Required knowledge**

Look for evidence that confirms knowledge of:

- specifications for the process control analyser to be installed
- procedures for maintaining process control analysers
- the maintenance to be undertaken and the frequency at which process control analysers are to be maintained
- procedures for determining correct function or the malfunction of process control analysers
- test equipment and diagnostic techniques required to determine correct function or malfunction of process control analysers
- procedures for recording test results and procedures for monitoring apparent faults

**REQUIRED SKILLS AND KNOWLEDGE**

- detected from test results
- probable causes of variations between test results and specifications
- procedures for reporting/recording faults and/or malfunctions in process control analysers
- action to be taken to return the process control analysers to specification and reasons for undertaking the proposed actions
- persons to be consulted in planning the corrective action
- sequence of actions to be taken
- procedures for marking components for repair, replacement or overhaul
- tools, equipment and techniques required to test components and reasons for marking components for repair, replacement and/or overhaul
- specifications for the component(s) to be replaced
- procedures, tools, techniques and equipment required to repair/overhaul the faulty items
- preparation requirements of items to be fitted/refitted
- procedures for preparing items for fitting/refitting
- procedures for fitting/refitting process control analysers
- tools, techniques and equipment required to fit/refit process control analysers
- preparation requirements of process control analysers prior to testing and calibration
- procedures for calibrating process control analysers
- physical standards against which process control analysers are to be calibrated
- devices, equipment and techniques required to calibrate process control analysers
- equipment and procedures for testing calibrated process control analysers
- probable causes of any variations/deviations detected
- action to be taken to return the process control analyser to specification and reasons for undertaking the proposed action(s)
- procedures for recommissioning process control analysers
- the safety precautions to be taken when recommissioning process control analysers
- procedures for reporting/recording service undertaken on process control analysers and reasons for recording service undertaken
- appropriate measuring techniques, tools and equipment
- hazards/control measures associated with maintaining, repairing instrumentation process control analysers
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to maintain, repair instrumentation process control analysers. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining, repairing instrumentation process control analysers, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18070C Modify complex electrical circuits and systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers checking circuits and systems and diagnosing faults, modifying systems as required and testing the modified system.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to modifications to electrical circuitry in machines, material transfer systems, distribution systems, complex control panels etc. incorporating a range of circuit protective devices, relays, timers, transformers, sensors, programmable controllers etc.</p> <p>A system's circuit is defined as one that interconnects a number of interdependent apparatus.</p> <p>A system's circuit is made up of more than one interconnecting circuit controlling and processing apparatus inputs and outputs.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM10003B	Install and test electrical wiring and circuits up to 1000 volts a.c./1500 volts d.c.
	MEM12002B	Perform electrical/electronic measurement
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18048B	Fault find and repair/rectify basic electrical circuits
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18051B	Fault find and repair/rectify complex electrical circuits

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the	Performance criteria describe the performance needed to
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essential outcomes of a unit of competency.	demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine system specifications and characteristics	<p>1.1. Complex circuit/system function and characteristics are determined with reference to circuit diagrams, specifications, schematics and/or consultation with technical adviser.</p> <p>1.2. System specifications and operational data is obtained, read and interpreted.</p> <p>1.3. Findings are verified using correct and appropriate techniques, procedures, tools and test equipment.</p> <p>1.4. Results are recorded and analysed to determine appropriate modification.</p>
2. Modify circuits and systems as required	2.1. Modifications are undertaken as determined to standard operating procedures.
3. Test modification	<p>3.1. Modifications are tested and monitored to assess suitability.</p> <p>3.2. Modifications are documented in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining appropriate system modifications
- analysing
- facilitating multiple processes
- obtaining and interpreting relevant circuit diagrams, flow charts, specifications,



**REQUIRED SKILLS AND KNOWLEDGE**

- schematics, engineering data sheets, etc.
- recording/reporting
- testing and monitoring electrical circuit/systems
- high level communicating
- undertaking calculations using formulae
- entering routine and familiar information onto proformas and standard workplace forms
- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- planning, sequencing operations
- checking and clarifying strategies

**Required knowledge**

Look for evidence that confirms knowledge of:

- system interrelationship and dynamics
- operation of complex electrical circuit/system
- implications of modifications to system including hazards
- operational specifications of the circuit/system
- common electrical test instruments and their application
- appropriate test equipment and its application to the testing of the modified circuit/system
- the reporting/recording requirements associated with the modification of complex electrical circuits and systems
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to modify complex electrical circuits and

<b>EVIDENCE GUIDE</b>	
	systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with modifying complex electrical circuits and systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Complex electrical circuits and systems</b>	Industrial control systems, automatic process machines, material transfer systems, distribution systems, complex control panels etc. incorporating a range of circuit protective devices, relays, timers, transformers, sensors etc.
<b>System</b>	A system's circuit is defined as one that interconnects between a number of interdependent apparatus
<b>Test equipment</b>	Continuity testers, ammeters, voltmeters, multimeters, tong testers, wattmeters, cathode ray oscilloscope, etc.
<b>Documented</b>	All modifications recorded or incorporated into drawings, schematics, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance&diagnostics
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## MEM18071B Connect/disconnect fluid conveying system components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers safely removing/replacing a range of fluid conveying components and assemblies, and inspecting/testing fluid conveying assemblies.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to repairs and replacement to pressure and suction systems on fixed and mobile plant/equipment, including marine, heavy plant and manufacturing plant applications.</p> <p>Fluid conveying system applications may include, but are not limited to, hydraulic, pneumatic, water, gas, acids/corrosives/alkalines, abrasives, petroleum and other dry/wet media.</p> <p>System pressures would typically range from MEM10005B MPa to 35 MPa, ranging up to 70 MPa. Functional testing of fluid conveying components and assemblies may include in-situ and high pressure test rigs.</p> <p>This unit should not be selected when Unit MEM18055B (Dismantle, replace and assemble engineering components) or Unit MEM18052B (Maintain fluid power systems for mobile plant) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Disconnect fluid conveying components and assemblies	1.1.Safety/risk assessment is carried out, potentially hazardous situations/conditions are identified and safety devices are positioned as required. 1.2.Fluid conveying conductor lay out is noted, recorded and labelled to standard operating procedures. 1.3.Faulty component/assembly is identified using specific trouble-shooting procedures, reference

ELEMENT	PERFORMANCE CRITERIA
	<p>documents and fluid power principles.</p> <p>1.4.Fluid conveying components and assemblies are disconnected and removed using appropriate techniques, procedures, tools and equipment.</p> <p>1.5.Open system is adequately sealed with standard or special purpose sealing materials.</p>
2. Obtain replacement parts	2.1.Replacement parts are selected from manufacturer catalogues and other relevant reference sources according to international standards and specifications.
3. Test and store components	<p>3.1.Fluid conveying assemblies and individual components are pressure tested according to industry and manufacturer standards and using fluid power principles.</p> <p>3.2.Condition is assessed and noted according to standard operating procedures.</p> <p>3.3.Components/assemblies are cleaned, sealed and stored according to industry and manufacturer standards.</p>
4. Connect fluid conveying components and assemblies	<p>4.1.Connections are checked and prepared for reconnection.</p> <p>4.2.Components and assemblies are connected to equipment to specifications using appropriate techniques.</p> <p>4.3.Tagged out equipment, signage and safety blocking devices are removed according to standard operating procedures.</p> <p>4.4.Equipment and fluid conveying systems are checked and tested for correct operation according to manufacturer and industry standards.</p>
5. Report results	<p>5.1.Reporting and certification procedures are followed.</p> <p>5.2.All relevant information is completed and correct.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- identifying potentially hazardous situations
- tagging, locking off safety/security
- locating faulty component
- neutralising pressures
- removing components/assemblies
- applying safe working practices
- sealing system
- interpreting reference materials to identify required part(s)
- performing pressure testing
- undertaking condition and serviceability assessment
- cleaning, sealing and storing components
- connecting components
- testing components
- completing routine reports

### Required knowledge

Look for evidence that confirms knowledge of:

- different sources of stored energy and their applications
- hazardous situations/conditions
- OHS responsibilities of customer and self
- safety/security lock-off devices and signage
- the reasons for installing lock-off devices and signage
- the procedures for installing lock-off devices and signage
- procedures to record and label components
- trouble shooting techniques
- techniques, procedures and safety practices including neutralisation of pressures
- standard and specific sealing materials and techniques
- different fluid conveying parts and their function
- techniques and safety practices for pressure testing
- basic functions of fluid power systems, including: effects of heat/contamination; pressures, flow rates and temperatures; hose strength and size; effect of media on hoses; test, operational and burst pressures
- criteria for assessment
- storage methods and requirements
- methods of cleaning, sealing and storing
- criteria for checking connection
- techniques for connection



**REQUIRED SKILLS AND KNOWLEDGE**

- procedure for removal
- testing procedures
- safety requirements
- reporting procedures and media for reporting
- required information

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to connect/disconnect fluid conveying system components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with connecting/disconnecting fluid conveying system components or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Potentially hazardous situations/conditions**

Accumulated pressure, contamination, fluid handling

**Reference documents**

Manufacturer product catalogues, tables and charts, schematic diagrams

**Components and assemblies**

High pressure seals, seats, hoses, tubes, pipes, fittings, connectors, adaptors and anchors, and other associated attachments

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18072B Manufacture fluid conveying conductor assemblies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing assembly and functional testing of fluid conveying components and assemblies. A range of fluid conveying components and assemblies is manufactured/assembled that may include high pressure seals, seats, hoses, tubes, pipes, fittings, connectors, adaptors and anchors, and other associated attachments.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of fluid conveying components on systems such as hydraulic, pneumatic, water, gas, acids/corrosives/alkalines, abrasives, petroleum and other dry/wet media.</p> <p>Conductor assemblies may apply to positive and negative pressure systems on fixed and mobile plant/equipment, including marine, heavy plant and manufacturing plant applications.</p> <p>Testing may be in-situ or using high pressure test rigs. System pressures would typically range from MEM10005B MPa to 35 MPa, ranging up to 70 MPa.</p> <p>Where brazing/soldering is required, Unit MEM05006B (Perform brazing and/or silver soldering) should also be selected. This unit is not to be selected when Unit MEM18055B (Dismantle, replace and assemble engineering components) or Unit (MEM18052B Maintain fluid power systems for mobile plant) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Manufacture fluid conveying system conductors	1.1. Conductor requirements are identified and appropriate materials/fittings are selected to suit application. 1.2. Conductor materials are prepared for assembly. 1.3. Conductors are assembled to specification.
2. Repair faulty	2.1. Faulty fluid conveying system conductors are

ELEMENT	PERFORMANCE CRITERIA
conductors and assemblies	dismantled and repaired to manufacturer/industry standards and specifications.
3. Check/test conductor assemblies	<p>3.1.Operation of fluid conveying components and assemblies is tested against current industry standards and manufacturer specifications using fluid power principles and relevant reference documents.</p> <p>3.2.Faulty fluid conveying components and assemblies are identified and failure/potential to fail is confirmed by inspection and testing using fluid power conveying principles, procedures, equipment and safety practices.</p> <p>3.3.Manufactured/repaired components are assembled, cleaned, tested and correct operation verified to ensure compliance with required specifications and standards.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying materials/fittings with reference to circuit drawings, schematics, reference manuals and equipment specifications
- preparing existing conductors
- assembling conductors
- applying safety practices
- following enterprise procedures
- identifying faults/potential faults
- inspecting for compliance/non-compliance with specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- conductor materials and fittings for a range of applications and media (fluid types)
- methods for preparation of different conductors, including hose and pipe assemblies

**REQUIRED SKILLS AND KNOWLEDGE**

- different methods for assembling hose and pipe assemblies, including swaging, crimping, brazing/soldering
- dismantle and repair procedures
- operational function and characteristics of fluid conveying installation and application category types
- industry standards and manufacturer specifications
- procedure to assess operation
- fluid power conveying principles, procedures and safety requirements
- procedures to assemble, clean, test

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to manufacture fluid conveying conductor assemblies. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

<b>EVIDENCE GUIDE</b>	
	with manufacturing fluid conveying conductor assemblies or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Conductor</b>	Hoses, tubes, pipes, fittings, connectors, adaptors and anchors and other associated attachments
<b>Assembled</b>	Hose - skive and measurement tools, crimping and cleaning machines, lathes
<b>Reference documents</b>	Manufacturer product catalogues, tables and charts, schematic diagrams



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18073A Perform advanced equipment testing and diagnostics on mobile plant and equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers obtaining and interpreting information to diagnose mobile plant and equipment faults, determining the cause, and making recommendations. It includes the use of electronic and analogue diagnostic tools.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the diagnosis of faults across the mobile plant including faults within the hydraulics, engine, power train and electronic systems and components.</p> <p>It also includes making recommendations for work to be undertaken on faults.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM16006A	Organise and communicate information
	MEM16008A	Interact with computing technology
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18010C	Perform equipment condition monitoring and recording
	MEM18030B	Diagnose and rectify low voltage electrical systems
	MEM18047B	Diagnose and maintain electronic controlling systems on mobile plant
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain information on mobile plant and equipment performance	<p>1.1.Job related information is accessed and interpreted.</p> <p>1.2.Information management systems are used to access data on plant and equipment performance.</p> <p>1.3.Previous records are reviewed.</p> <p>1.4.Equipment systems operation, testing and adjusting procedure is reviewed and troubleshooting procedure is identified.</p> <p>1.5.Hazards associated with plant and equipment tests are identified.</p>
2. Identify equipment fault/s	<p>2.1.Data from information management system is interpreted.</p> <p>2.2.Fault symptoms are determined.</p> <p>2.3.Equipment operation is visually inspected.</p> <p>2.4.All test equipment is installed at the correct test point locations.</p> <p>2.5.Performance tests are conducted as required.</p> <p>2.6.Information from tests and test equipment is analysed.</p> <p>2.7.Fault is identified.</p> <p>2.8.Data is plotted and recorded on performance analysis report forms.</p>
3. Determine cause of fault/s	<p>3.1.Possible causes are identified.</p> <p>3.2.Diagnostic tests are conducted to confirm cause.</p> <p>3.3.Test results are analysed.</p> <p>3.4.Test results are compared with specifications.</p> <p>3.5.Cause of fault is located and documented.</p>
4. Make recommendations	<p>4.1.Recommendations for repair are made.</p> <p>4.2.Rectification strategy is implemented.</p>
5. Check and document repairs	<p>5.1.Repairs are checked for completion.</p> <p>5.2.Equipment is re-tested to ensure correct performance.</p> <p>5.3.Service report is prepared and completed.</p> <p>5.4.Required documentation is completed.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information
- problem solving
- checking for conformance to specifications
- using tools and equipment to conduct performance and fault finding tests
- undertaking root cause analysis
- undertaking calculations and numerical operations within the scope of this unit
- using computer
- using information management systems
- making recommendations for rectifying faults
- implementing and reviewing rectification strategy
- documenting findings and outcomes

#### Required knowledge

Look for evidence that confirms knowledge of:

- hazards and control measures associated with conducting tests and fault finding across equipment, including housekeeping
- safe work practices and procedures
- tests to be conducted to diagnose faults at equipment and component level
- sources of information available to assist in fault finding
- uses and parameters of information management systems
- required rectification for equipment faults
- practices and procedures in root cause analysis
- equipment performance specifications
- documentation requirements

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake advanced equipment testing and diagnostics. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with advanced equipment testing and diagnostics, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

## EVIDENCE GUIDE

### Guidance information for assessment

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Mobile plant and equipment

Hydraulics, engine, power train and electronic systems

#### Job related information

Personnel accounts/descriptions, log books, job records standard operating procedures, manufacturers' specifications

#### Accessed

By manual or electronic means

#### Previous records

Equipment logs and history

#### Hazards

- Ventilation hazards including battery gas leaks and (freon) paint emission
- Excessive noise
- Fluid spillage
- Electrical hazards from generator sets and water
- Lifting hazards caused by the removal and replacement of heavy components, e.g. engines and transmissions
- Hydraulic hazards such as high oil pressure and temperature
- Drive trains hazards such as tail shaft wind up
- Fire hazards from the activation of fuel and temperature

#### Information management systems include

- Retrieving test data from the Service Information System (SIS)

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Equipment management systems</li> <li>• Factory passwords</li> <li>• Finding test data through, microfiche and SIS</li> <li>• Obtaining relevant Flash File information</li> <li>• Finding full load settings (FLS) and full torque settings (FTS), SIS or similar</li> <li>• Using the dynamometer and windows performance analysis reporting programs</li> <li>• Producing performance analysis report</li> </ul>
<b>Test equipment</b>	Dynamometer, electronic technician, multimeter, flow meter, pressure gauges, communication adaptors, scroll box and stop watch
<b>Performance tests</b>	<ul style="list-style-type: none"> <li>• Rocker checks for oil</li> <li>• Fluid level checks</li> <li>• Fuel and cooling system checks</li> <li>• Emergency shut-down operation checks</li> <li>• Final walk around inspection</li> <li>• Manual and/or electronic tests of equipment and/or components</li> <li>• Cylinder cut out tests</li> <li>• Solenoid tests</li> <li>• Cycle times</li> <li>• Sensor tests</li> <li>• Lubrication pressure checks</li> <li>• Leak checks</li> <li>• Power checks using the dynamometer program, engine performance tools, transmission and hydraulic test equipment</li> <li>• Checks on alignments between components</li> </ul>
<b>Rectification strategy</b>	Repair, referral, replacement, dispatch to other personnel

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18084A Commission and de commission split air conditioning systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers commissioning and decommissioning of split air conditioning systems to relevant standards, codes and local regulations.
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### Application of the Unit

<b>Application of the unit</b>	<p>It includes the application of safe working practices, following standard procedures to pressure test, evacuate, recover, charge and perform functional checks to test system performance.</p> <p>This unit refers to plug in appliances only. For hard wired installations a licensed electrical tradesperson must undertake connection and disconnection.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing

Prerequisite units		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine the operating conditions of vapour compression systems	<p>1.1. Established procedures are used to determine the actual and specified range of operating conditions from measured and calculated values as they apply to particular vapour compression systems.</p> <p>1.2. Established OHS procedures and risk control measures for carrying out the work are followed.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.3. Operating conditions are established and recorded on commissioning documentation.</p> <p>1.4. Tools, equipment and testing devices needed to determine the basic operating conditions are obtained and checked for correct operation and safety</p> <p>1.5. The system is checked and isolated where necessary, in strict accordance OHS requirements and procedures</p>
2. Recover refrigerants from split air conditioning systems	<p>2.1. Circuits/appliances are isolated where necessary in strict accordance OHS requirements and procedures.</p> <p>2.2. Refrigerants are removed safely into suitably labelled containers in accordance with legislative and industry requirements.</p> <p>2.3. Contaminated refrigerant is dealt with in accordance with legislative and industry requirements.</p>
3. Pressure and leak test split air conditioning systems	<p>3.1. Safety hazards are identified and noted and established risk control measures are implemented.</p> <p>3.2. Industry codes of practice and manufacturer installation instructions are followed.</p> <p>3.3. Precautions are taken to prevent damage to components while pressure testing the system.</p> <p>3.4. Pressure testing is conducted at a pressure compatible with the refrigerant to be used.</p> <p>3.5. Leaks are located, isolated and repaired using methods appropriate to the system type under test and in accordance with industry practices.</p>
4. Evacuate split air conditioning systems	<p>4.1. Safety hazards which have not previously been identified are noted, and established risk control measures are implemented.</p> <p>4.2. The system is evacuated to the required level and cleaned the system of all moisture and other containments in accordance with legislative and industry requirements.</p> <p>4.3. A standing vacuum test is applied in accordance with industry codes of practice and applicable standards.</p>

ELEMENT	PERFORMANCE CRITERIA
5. Charge split air conditioning systems	<p>5.1. Correct refrigerant is selected for the system, in accordance with manufacturer requirements and industry practices.</p> <p>5.2. The refrigerant charge is measured by weight in accordance with manufacturer specifications.</p> <p>5.3. The system is charged correctly in accordance with manufacturer requirements and industry practices.</p> <p>5.4. All components are checked and maintained in accordance with manufacturer requirements.</p>
6. Test the operation of split air conditioning systems	<p>6.1. The system is started and operated in accordance with manufacturer instructions</p> <p>6.2. Standard tests are carried out to confirm system performance to manufacturer specifications.</p> <p>6.3. The refrigerant charge is checked and refrigerant added if required.</p> <p>6.4. The system is leak checked in accordance with refrigeration procedures and practices.</p> <p>6.5. Test data is recorded as required.</p>
7. Complete the commissioning/recommissioning of split air conditioning systems	<p>7.1. The worksite is cleaned and left in presentable condition in accordance with original presentation, client requirements, industry standards and organisational requirements.</p> <p>7.2. Final inspections are undertaken to ensure installation conforms with industry, legislative and work order requirements.</p> <p>7.3. The client is instructed on the use of the product in accordance with organisational requirements and manufacturer specifications.</p> <p>7.4. Certificates of compliance and other relevant commissioning documentation are completed and processed in accordance with State regulatory requirements.</p>
8. Decommission split air conditioning systems	<p>8.1. Plug in appliance is electrically disconnected or arrangements made for appropriately licensed person to isolate hard-wired appliances</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>8.2.Refrigerants are recovered, stored and disposed of in accordance with legislative and industry requirements.</p> <p>8.3.Units and components are removed and disposed of safely and in accordance with regulations, industry codes of practice and sustainable environmental practices.</p> <p>8.4.The worksite is cleaned and left in presentable condition, client and organisational requirements, industry standards and sustainable environmental practices.</p> <p>8.5.Decommissioning documentation is completed and processed in accordance with State regulatory requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, catalogues, lists, drawings and other applicable reference documents
- effective communication with appropriate persons
- planning and sequencing operations
- checking and clarifying task related information
- using tools, techniques and equipment necessary to check for correct operation
- comparing system and component performance/ operation against specification
- identifying faulty components and non-compliances
- using appropriate test equipment to identify non-compliance
- safely removing, containing and adding refrigerant to relevant Australian Standards or codes and regulations
- making required adjustments to achieve specifications
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken

## REQUIRED SKILLS AND KNOWLEDGE

- completing relevant commissioning and decommissioning documentation

### Required knowledge

Look for evidence that confirms knowledge of:

- applicable legislative and regulatory requirements, standards, codes, licensing requirements and sustainable environmental practices for commissioning and decommissioning systems
- applicable procedures and legislative requirements for storage, handling and treatment of ozone depleting and synthetic greenhouse gas refrigerant
- procedures to determine the actual and specified range of operating conditions from measured and calculated values as they apply to particular vapour compression systems
- typical work environments, demands and considerations
- specifications, operational characteristics and process for identifying system components
- typical problems, contingencies and solutions
- applicable tools, equipment and testing devices and their operation
- procedures for evacuating system
- procedures for leak testing
- procedures for adding refrigerant
- requirements and procedures to isolate circuits/appliances
- procedures for checking air flow
- measuring instruments/equipment, specifications and procedures for checking temperature and system performance
- measuring instruments/equipment, specifications and procedures for checking components
- procedures for reporting non-conformances
- process for identifying refrigerant type
- types of commissioning documentation
- requirements and procedures for completing documentation
- OHS procedures and risk control measures
- hazards and risk control measures associated with commissioning split and domestic air conditioning systems

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

**EVIDENCE GUIDE**

performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to install split air conditioning systems to manufacturer specifications, safely, to relevant Australian Standards, codes and regulations.

Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with commissioning, recommissioning and decommissioning split air conditioning systems or domestic air conditioning and refrigeration appliances and other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,



**EVIDENCE GUIDE**

	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Tools, equipment and testing devices</b>	Refrigeration gauge manifold, Schraeder access valves; quick connect couplings, thermometer/thermocouple temperature measuring devices; analogue and digital vacuum measuring gauges; digital scales; refrigerant recovery unit; vacuum pump; electronic leak detectors, refrigerant containers/cylinders
<b>Legislative and industry requirements</b>	<ul style="list-style-type: none"> <li>Commonwealth, State and Territory legislation, regulations, standards and industry codes of practice</li> <li>The Ozone Protection and Synthetic Greenhouse Gas Legislation Amendment Bill 2003; Air conditioning residential best practice guidelines (AIRAH); State and local building regulations</li> <li>Sustainable environmental practices for commissioning and decommissioning split air conditioning and domestic refrigeration.</li> </ul>
<b>System performance</b>	Pressure; temperature; sub cooling; superheating; evaporator coil to air temperature difference
<b>Residential split air conditioning systems</b>	Single head split systems up to 18kw cooling capacity
<b>Domestic refrigeration and air</b>	Domestic refrigeration and air conditioning

**RANGE STATEMENT**

<b>conditioning systems</b>	systems being self contained 240 volt plug in self contained appliances primarily used in domestic/residential situations
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Installation and commissioning
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## MEM18085A Install, service and repair domestic air conditioning and refrigeration appliances

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing, servicing and repairing domestic air conditioning and refrigeration appliances to relevant standards, codes and local regulations.
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency is limited to domestic air conditioning and refrigeration systems only. It includes the application of safe working practices, following standard procedures to perform functional checks, test system performance and carry out straightforward maintenance.</p> <p>This unit refers to plug in appliances only. For hard wired installations a licensed electrical tradesperson must undertake connection and disconnection.</p> <p>Aspects of this unit may require a restricted electrical license in some jurisdictions.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05006C	Perform brazing and/or silver soldering
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Install and remove domestic	1.1.Appliance location is identified and sited in accordance with customer requirements, regulations,

ELEMENT	PERFORMANCE CRITERIA
refrigeration and air conditioning appliances	<p>standards, codes of practice and industry guidelines</p> <p>1.2.Site is prepared for installation of appliance</p> <p>1.3.Appliance is installed and secured in accordance with manufacturer instructions and industry best practice</p> <p>1.4.Operation of the appliance is checked in accordance with manufacturer instructions</p> <p>1.5.Waste materials and products are disposed of in accordance with Commonwealth and State legislation, environmental and industry codes of practice</p>
2. Determine operating condition of domestic refrigeration and air conditioning appliances	<p>2.1.Established procedures and standard electrical tests are carried out to determine actual operating condition</p> <p>2.2.Established OHS risk control measures and procedures are followed to enable the system to be isolated and checked where necessary</p> <p>2.3.Tools, equipment and testing devices needed to determine the basic refrigeration operating conditions are obtained and checked for correct operation and safety</p> <p>2.4.Industry codes of practice and manufacturer service instructions are followed</p>
3. Carry out routine maintenance of domestic refrigeration and air conditioning appliances	<p>3.1.Safety hazards are identified and recorded and established risk control measures implemented</p> <p>3.2.Routine maintenance procedure is performed as per manufacturer and client scheduling</p> <p>3.3.Routine maintenance records are maintained and faults recorded</p>
4. Fault-find and troubleshoot domestic refrigeration and air conditioning appliance faults	<p>4.1.OHS requirements are determined</p> <p>4.2.Equipment and testing devices needed to determine fault are selected</p> <p>4.3.Apply standard test procedures to determine faults against equipment specifications</p> <p>4.4.Test data and faults are recorded as required</p>
5. Replace, repair or service faulty components in domestic refrigeration and air conditioning	<p>5.1.Plug in appliance is electrically disconnected or arrangements made for appropriately licensed person to isolate hard-wired appliances</p> <p>5.2.Electrical components are replaced in accordance with manufacturer recommendation and industry best practice</p>

ELEMENT	PERFORMANCE CRITERIA
appliances	<p>5.3.Refrigeration system replacement components are selected and prepared</p> <p>5.4.Refrigerants are recovered, stored and disposed of in accordance with Commonwealth legislation and industry codes of practice</p> <p>5.5.Refrigeration system components are installed in accordance with industry best practice, standards and codes</p> <p>5.6.Refrigeration system is returned to operating condition using standard refrigeration return to service procedures</p>
6. Return to service domestic refrigeration and air conditioning appliances	<p>6.1.Standard electrical tests are applied to identify electrical faults before operating</p> <p>6.2.Appliance is started and operated in accordance with manufacturer standards</p> <p>6.3.Standard tests are carried out to confirm system performance to manufacturer specifications</p> <p>6.4.Appliance operating data is recorded as required</p> <p>6.5.Worksite is cleaned and left in presentable condition in accordance with original presentation, client requirements, industry standards and organisational requirements</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task related information
- attaching ancillary devices
- using tools, techniques and equipment necessary to check for correct operation
- comparing system and component performance/ operation against specification

## REQUIRED SKILLS AND KNOWLEDGE

- identifying faulty components and non compliances
- using appropriate test equipment to identify non compliance
- safely remove, contain or add refrigerant to relevant Australian Standards or codes and regulations
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- completing relevant standard, code or local required documentation

### Required knowledge

Look for evidence that confirms knowledge of:

- procedures and industry best practice for brazing refrigeration pipework
- procedures for evacuating system
- procedures for pressure and leak testing
- procedures for handling and adding refrigerant
- safety and legislative requirements for handling refrigerants
- procedure for checking air flow
- standard electrical measurements for earth continuity, insulation resistance, circuit resistance, supply voltage and current
- measuring instruments/equipment, specifications and procedures for checking temperature and system performance
- measuring instruments/equipment, specifications and procedures for checking and testing components
- procedures for reporting non-conformances
- specifications, operational characteristics and process for identifying system components
- process for identifying refrigerant type
- procedures complying to all legislative and regulatory requirements for safely removing the refrigerant and charging and evacuating the system
- procedures for completing documentation
- hazards and control measures associated with installing split air conditioning systems, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to install service and repair domestic refrigerators and air conditioners to manufacturer specifications, safely, to relevant Australian Standards, codes and regulations.

Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing, servicing and repairing domestic refrigerators and air conditioners or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures,



**EVIDENCE GUIDE**

	product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Routine maintenance</b>	Electrical testing of the appliance, polarity testing, cleaning condensers, clearing drains, checking temperatures, pressures, component operation, air flow and system capacity, cleaning filters.
<b>Standard electrical tests</b>	Earth continuity, Insulation resistance, and Circuit resistance to meet electrical equipment regulations and codes (AS3000). Testing of supply voltage and the appliance or individual component current draw.
<b>Equipment and testing devices</b>	Refrigeration gauge manifold, Schraeder access valves; quick connect couplings, thermometer/thermocouple temperature measuring devices; analogue and digital vacuum measuring gauges; digital scales; refrigerant recovery unit; vacuum pump; electronic leak detectors, refrigerant containers/cylinders.
<b>Industry best practice</b>	Pipe fabrication techniques and industry best practice for pipe brazing.
<b>Standard refrigeration return to service procedures</b>	Leak detection, evacuation, and refrigerant charging of domestic air conditioning and refrigeration plug in appliances.

<b>RANGE STATEMENT</b>	
<b>Commonwealth, State and Territory legislation, regulations, standards and codes of practice, industry guidelines</b>	The Ozone Protection and Synthetic Greenhouse Gas Legislation Amendment Bill 2003; air conditioning residential best practice guidelines (AIRAH); State and local building regulations; Codes of Practice for domestic refrigeration and air conditioning. (HB40)
<b>System performance</b>	Pressure; temperature; sub cooling; superheating; evaporator coil to air temperature difference
<b>Domestic refrigeration and air conditioning appliances</b>	Self contained plug in appliances primarily designed for domestic and residential situations: <ul style="list-style-type: none"> <li>refrigerators - single door, two door and two door side by side</li> <li>freezers - chest and vertical door using, for example, refrigeration systems with cyclic defrost, frost-free with electric and hot-gas defrost, and manual defrost.</li> <li>air conditioners (window and wall mounted self-contained room air conditioners)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

Competency field	Installation and commissioning
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# MEM18086B Test, recover, evacuate and charge refrigeration systems

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers testing, recovering, evacuating and charging refrigeration systems to achieve performance specification.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to refrigeration systems associated with refrigeration and air conditioning, including commercial, industrial, domestic, marine and transport applications.</p> <p>The application of this competency must cover a variety of refrigeration equipment and systems.</p> <p>Demonstration of competency must be in accordance with Australian Standards, including AS - HB40 Refrigeration and Air Conditioning codes of practice, and relevant ozone and greenhouse substance legislation.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess refrigeration system operation	<p>1.1.Refrigeration system operating principles and terminology are applied to assessment activities.</p> <p>1.2.All <i>relevant information</i> is obtained and correctly interpreted prior to the commencement of work on the refrigeration system.</p> <p>1.3.Refrigeration system checks are undertaken safely in accordance with standard operating procedures,</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>relevant codes and regulations.</p> <p>1.4. Appropriate operating procedures are developed as required.</p> <p>1.5. Pressures and temperatures are correctly determined and recorded.</p> <p>1.6. Faults are correctly isolated to component level and <i>appropriate corrective action</i> is determined.</p> <p>1.7. The refrigeration system is checked for leaks.</p> <p>1.8. The refrigeration system is checked for <i>contamination</i>.</p>
2. Recover refrigerant and evacuate system	<p>2.1. The <i>refrigerant</i> in the system is recovered in accordance with standard operating procedures, codes and regulations.</p> <p>2.2. The refrigerant recovered from the refrigeration system is contained in accordance with the <i>relevant codes and regulations</i>.</p> <p>2.3. The refrigeration system is evacuated in accordance with standard operating procedures, codes and regulations.</p>
3. Charge the refrigeration system	<p>3.1. The refrigeration system is charged with the correct refrigerant in accordance with standard operating procedures.</p> <p>3.2. The appropriate lubricating oil is added to the refrigeration system in accordance with standard operating procedures.</p> <p>3.3. The refrigeration system is checked for leaks.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and sequencing operations
- developing operating procedures for equipment as required
- selecting correct refrigerant for a given system

**REQUIRED SKILLS AND KNOWLEDGE**

- obtaining and interpreting drawings, instructions, specifications, procedures, codes and regulations
- testing and checking refrigeration components and systems including electrical safety checks and tests
- checking for conformance to specifications
- undertaking numerical operations within the scope of this unit
- determining pressures and temperatures
- documenting test results and procedures undertaken
- using equipment and test techniques
- identifying faulty components and system contamination
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- selecting appropriate materials, equipment and solutions for specific refrigeration systems

**Required knowledge**

Look for evidence that confirms knowledge of:

- operating principles of refrigeration systems
- characteristics, properties and operating specifications of each type of refrigerant
- safety precautions and work practices to be undertaken when handling or working with refrigerants
- methods of identifying stored refrigerants
- methods of identifying the type of refrigerant used in refrigeration systems
- relevant codes and regulations applying to refrigeration systems
- procedures and safety precautions for testing/checking refrigeration systems
- corrective actions for system and component faults including appropriate basic electrical safety checks
- types of leak detection equipment/techniques and their applications
- causes of contamination in refrigeration systems and their effect on refrigeration system performance
- procedures, tools and equipment to be used to clean up contaminated systems
- care and use of vacuum pumps
- tools, techniques and equipment required to carry out recovery procedures
- procedures for storing/disposing of recovered refrigerant
- consequences of releasing quantities of refrigerant into the atmosphere
- procedures for charging refrigeration systems
- correct refrigerant for a range of given applications
- tools, techniques and equipment required to charge a refrigeration system with refrigerant
- precautions to be taken when charging by various methods, refrigeration systems with refrigerant

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for checking level and adding lubricating oil
- properties and uses of refrigeration oil
- hazards and control measures associated with handling refrigerants, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to test, recover, evacuate and charge refrigeration systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the assessment, evacuation and charging of refrigeration systems, or other units requiring the exercise of the skills and knowledge covered by this unit.



<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Relevant information</b>	Manufacturers' technical data, pressure temperature charts, operating manuals
<b>Appropriate operating procedures</b>	In the case where specific equipment does not have standard operating procedures
<b>Appropriate corrective action</b>	Isolation and tagging of faulty components, repair and/or replacement
<b>Contamination</b>	Moisture, non-condensables, solids, acids etc.
<b>Refrigerant</b>	All refrigerants including CFCs, HCFCs, HFCs, natural refrigerants, ammonia, etc.
<b>Relevant codes and regulations</b>	Australian Standards Refrigeration and Air Conditioning codes of practice, relevant ozone

**RANGE STATEMENT**

	and greenhouse substance legislation
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**Unit Sector(s)**

Unit sector	
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**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	Maintenance and diagnostics
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## MEM18087B Service and repair domestic and light commercial refrigeration and air conditioning equipment

### Modification History

Prerequisite unit MEM05006B updated to MEM05005C

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers servicing of domestic and light commercial refrigeration and air conditioning equipment and components.</p> <p>It includes interpreting diagrams of refrigeration and air conditioning equipment; utilising basic fault finding procedures, service manifolds and test equipment to identify and diagnose faults in equipment; isolating faulty components including control components; and rectifying common faults.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to retrofitting existing domestic and light commercial refrigeration and air conditioning equipment with alternative refrigerants; reconditioning components; returning to service; testing equipment; and completing service reports for administrative action. Prerequisite pathways must be applied within a refrigeration/air conditioning context.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM05006C	Perform brazing and/or silver soldering
	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on domestic/light commercial refrigeration/air conditioning	<ul style="list-style-type: none"><li>1.1. Visual inspection and testing with appropriate test equipment are carried out according to refrigeration/air conditioning principles, procedures and safety requirements.</li><li>1.2. Preventative maintenance tasks are performed according to manufacturers' specifications using refrigeration/air conditioning techniques/practices.</li></ul>
2. Undertake fault finding on domestic/light commercial refrigeration/air conditioning equipment	<ul style="list-style-type: none"><li>2.1. Equipment components are identified correctly.</li><li>2.2. The characteristics and operation of each component is understood.</li><li>2.3. The operational function of each component is inspected and tested.</li><li>2.4. Correct operation of each component is assessed against specification.</li></ul>
3. Repair/replace faulty domestic/light commercial refrigeration/air conditioning components	<ul style="list-style-type: none"><li>3.1. Faulty components are localised and malfunction is confirmed by inspection and testing using refrigeration and air conditioning principles, procedures and safety requirements.</li><li>3.2. The refrigerant is removed safely from the system and contained in accordance with standard operating procedures and regulatory requirements where appropriate.</li><li>3.3. Faulty components are dismantled and repaired/replaced to manufacturers' specifications as required.</li><li>3.4. Replacement parts are selected from manufacturers' catalogues according to required specifications and relevant legislation.</li></ul>
4. Return to service domestic/light commercial refrigeration/air conditioning equipment	<ul style="list-style-type: none"><li>4.1. Components are reassembled and tested for correct operation and assessed against specification.</li><li>4.2. Using domestic refrigeration/air conditioning principles and system application techniques, correct operation of the equipment is verified.</li><li>4.3. Maintenance records/service reports are completed by appropriate designated means.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check refrigeration/air conditioning system components for correct operation
- obtaining, reading and interpreting specifications
- comparing component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- undertake calculations and numerical operations within the scope of this unit
- recording and reporting service activities

#### Required knowledge

Look for evidence that confirms knowledge of:

- preventative maintenance requirements
- variations in component identities
- operation and characteristics of range of components
- procedures for checking refrigeration/air conditioning components for correct operation
- procedures for identifying components for repair or replacement
- recovery, containment and storage procedures
- effect of poor repair practices
- processes and resources to select replacement parts
- assembly procedures
- procedures, tools, techniques and equipment for adjusting refrigeration/air conditioning systems for correct operation and to specification
- procedures for obtaining authorisation of adjustments outside of operational specifications

## REQUIRED SKILLS AND KNOWLEDGE

- basic electrical principles, testing and fault identification
- hazards and control measures associated with the service and repair of domestic and light commercial refrigeration and air conditioning equipment
- safe work practices and procedures
- codes and regulations relevant to the refrigeration/air conditioning industry including environmental and ozone and greenhouse substance legislation

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to service and repair domestic and light commercial refrigeration and air conditioning equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with servicing of domestic and light commercial refrigeration and air conditioning equipment and components or other units requiring the exercise of the

<b>EVIDENCE GUIDE</b>	
	skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Test equipment</b>	Pressure gauges, vacuum gauges, multimeter, ampmeter, megohm meter, vacuum pump
<b>Preventative maintenance tasks</b>	Check/adjust fan belts, check/clean filters, check/clean heat exchangers (evaporator and condenser), overhaul of major system components, cleaning of major system components, testing operation of all control and safety devices, testing refrigeration charge, testing operational current, testing insulation resistance of relevant electrical components
<b>Relevant legislation</b>	Noise and environmental regulations. Other applicable Commonwealth, State and Territory



<b>RANGE STATEMENT</b>	
	regulations and legislation

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18088B Maintain and repair commercial air conditioning systems and components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers maintaining and repairing commercial air conditioning systems and components.
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### Application of the Unit

<b>Application of the unit</b>	<p>It includes interpreting drawings and diagrams of commercial air conditioning systems; utilising fault finding procedures, service manifolds and test equipment to identify and diagnose faults; rectifying common faults; returning to service; testing systems; and completing service reports.</p> <p>This unit applies to commercial air conditioning systems and components - including heating systems, direct expansion refrigeration systems, and/or simple air distribution systems - typically used for comfort air conditioning.</p> <p>It may also apply to include retrofitting existing commercial air conditioning systems with alternative refrigerants and reconditioning components. The application of this competency must cover a variety of refrigeration and air conditioning equipment and systems.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on commercial air conditioning systems and components	<p>1.1.The temperature, quality, properties and flow of air delivered by the air conditioning system is checked for conformance to specification.</p> <p>1.2.The noise/vibration levels of the air conditioning system components are checked for conformance to specification.</p> <p>1.3.Preventative maintenance tasks are performed according to manufacturers' specifications using refrigeration and air conditioning principles and techniques.</p>
2. Undertake fault finding on commercial air conditioning systems and components	<p>2.1.System components are identified correctly.</p> <p>2.2.The characteristics and operation of each component are explained.</p> <p>2.3.The operational function of each component is inspected and tested.</p> <p>2.4.Correct operation of each component is assessed against system specification.</p>
3. Repair/replace faulty commercial air conditioning components	<p>3.1.Faulty components are localised and malfunction confirmed by inspection and testing using air conditioning principles, procedures and safety requirements.</p> <p>3.2.The refrigerant is removed safely from the system and contained in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>3.3.Faulty components are dismantled and repaired to manufacturers' specifications as required.</p> <p>3.4.Replacement parts are selected from manufacturers' catalogues according to required specifications.</p>
4. Return to service commercial air conditioning systems and components	<p>4.1.Components are reassembled and tested for correct operation and assessed against specification.</p> <p>4.2.The system is charged with correct refrigerant safely and in accordance with standard operating procedures and regulatory requirements.</p> <p>4.3.Using air conditioning principles, correct operation of the equipment is verified.</p> <p>4.4.Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and using equipment for testing and checking temperature, flow and quality of the conditioned air
- checking task-related information
- identifying faults and non-compliances
- making required adjustments to achieve specifications
- comparing operation of each system component against system specification
- planning and sequencing operations
- entering routine and familiar information onto proformas and standard workplace forms
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents

#### Required knowledge

Look for evidence that confirms knowledge of:

- measuring instruments/equipment and specifications for checking air temperatures, air flows, air quality and air properties
- procedures for reporting non-conformances
- air properties controlled by the air conditioning system
- measuring instruments/equipment and specifications required for checking component noise and vibration levels
- procedures and sequence for performing preventative maintenance on air conditioning systems
- specifications and process for identifying system components
- operational characteristics of the system components
- procedures for inspecting and testing system components and operational compliance
- procedures for assessing that the operation of system components meet system specification
- appropriate process for localising and confirming faulty components
- procedures and all legislative and regulatory requirements for safely removing the refrigerant from the system and charging the system
- procedures for dismantling and repairing faulty components and selecting

## REQUIRED SKILLS AND KNOWLEDGE

- replacement parts
- procedures for reassembling and testing components
- procedures for completing maintenance records/service reports
- hazards and control measures associated with maintaining and repairing commercial air conditioning systems and components
- safe work practices and procedures
- selecting and using equipment for testing electrical compliance of equipment
- documenting and reporting
- calculations and numerical operations within the scope of this unit

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair commercial air conditioning systems and components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with the maintenance and repair of commercial air conditioning systems and components or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Preventative maintenance tasks</b>	Check/adjust fan belts, check/clean filters, check/clean heat exchangers (evaporator and condenser), overhaul of major system components, cleaning of major system components, testing operation of all safety devices

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18089B Maintain and repair central air handling systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers maintaining and repairing large central air handling systems. It includes interpreting drawings and diagrams of large central air handling systems; utilising fault finding procedures and testing equipment to identify and diagnose faults in systems and isolate faulty components; rectifying faults; returning to service; testing the systems; and completing service reports.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to air handling systems including boilers, chillers, secondary refrigeration pumps, dehumidifiers, odour control, complex filtering systems, multi zone air distribution systems, etc., typically used for comfort air conditioning. The application of this competency must cover a variety of refrigeration and air conditioning equipment and systems. Prerequisite pathways must be applied within a refrigeration / air conditioning context.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM13007B	Maintain water treatment systems for cooling towers
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on large central air handling systems	<p>1.1.The temperature, humidity, quality, pressure and flow of air delivered to zones by the air handling system are checked for conformance to specification.</p> <p>1.2.The noise/vibration levels of the air handling sub-systems are checked for conformance to specification.</p> <p>1.3.Preventative maintenance tasks are performed according to manufacturers' specifications using appropriate refrigeration and air conditioning techniques/practices.</p>
2. Undertake fault finding on large central air handling systems	<p>2.1.Components of sub-systems are correctly identified.</p> <p>2.2.The characteristics and operation of each sub-system component can be explained.</p> <p>2.3.The operational function of each sub-system component is inspected and tested.</p> <p>2.4.Correct operation of each component is assessed against specification.</p>
3. Repair/replace faulty air handling components	<p>3.1.Faulty components are localised and malfunction is confirmed by inspection and testing using air conditioning principles, procedures and safety requirements.</p> <p>3.2.Faulty components are dismantled and repaired to</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>manufacturer' specifications as required.</p> <p>3.3.Replacement parts are selected from manufacturers' catalogues according to required specifications.</p>
4. Return to service large central air handling systems	<p>4.1.Components are reassembled and tested for correct operation and assessed against specification.</p> <p>4.2.Correct operation of the equipment is verified using air handling principles and techniques.</p> <p>4.3.Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check large central air conditioning system, sub-systems and components for correct operation
- obtaining, reading and interpreting specifications
- comparing system, sub-systems and component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- undertaking calculations and numerical operations within the scope of this unit
- using tools, techniques and equipment necessary to check large central air conditioning system, sub-systems and components for correct operation

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- appropriate measuring instruments/equipment and specifications for checking humidity, air temperatures, air flows, air quality and air pressure
- procedures for reporting non-conformances
- measuring instruments/equipment and specifications required for checking sub-system noise and vibration levels
- procedures and sequence for performing preventative maintenance on an air conditioning system
- specifications of and process for identifying primary and secondary refrigerant, or air distribution/reticulation systems
- operational characteristics of each sub-system component
- procedures and specifications for inspecting and testing each sub-system component
- process for localising and confirming faulty components
- procedures for dismantling and repairing faulty components
- procedures for selecting replacement parts
- procedures for completing maintenance records/service reports
- hazards and control measures associated with maintaining and repairing large central air handling systems
- safe work practices and procedures
- codes and regulations relevant to the refrigeration/air conditioning industry including environmental and ozone and greenhouse substance legislation

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair large central air handling systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the maintenance and repair of large central air handling systems or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

**RANGE STATEMENT**

situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Preventative maintenance tasks**

Check/adjust fan belts, check/clean filters, check/clean heat exchangers (evaporator and condenser), overhaul of major system components, cleaning of major system components, testing operation of all safety devices

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18090B Maintain and repair industrial refrigeration systems and components

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers maintaining and repairing industrial refrigeration systems. It includes interpreting drawings and diagrams of industrial refrigeration systems systems; utilising fault finding procedures and testing equipment to identify and diagnose faults in systems and isolate faulty components; rectifying faults; returning to service; testing the systems; and completing service reports.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to industrial refrigeration systems that may include large capacity plant typically used for product/process temperature/environment control. Work may also include retrofitting existing industrial refrigeration systems and reconditioning components. The application of this competency must cover a variety of refrigeration and air conditioning equipment and systems. Prerequisite pathways must be applied within a refrigeration/air conditioning context.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM05006C	Perform brazing and /or silver soldering
	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM10010B	Install pipework and pipework assemblies
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the	Performance criteria describe the performance needed to
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essential outcomes of a unit of competency.	demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on industrial refrigeration systems and components	<p>1.1. The temperature and properties of the controlled medium/s are checked for conformance to specification.</p> <p>1.2. The noise/vibration levels of the industrial refrigeration system components are checked for conformance to specification.</p> <p>1.3. Preventative maintenance tasks and plant room safety equipment checks are performed according to manufacturers' specifications using refrigeration principles techniques/practices.</p>
2. Undertake fault finding on industrial refrigeration systems and components	<p>2.1. System components are identified correctly.</p> <p>2.2. The characteristics and operation of each component is understood.</p> <p>2.3. The operational function of each component is inspected and tested.</p> <p>2.4. Correct operation of each component is assessed against specification.</p>
3. Repair/replace faulty industrial refrigeration components	<p>3.1. Faulty components are localised and malfunction is confirmed by inspection and testing using industrial refrigeration principles, procedures and safety requirements.</p> <p>3.2. The refrigerant is removed safely from the system and contained in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>3.3. Faulty components are dismantled and repaired to manufacturers' specifications as required.</p> <p>3.4. Replacement parts are selected from manufacturers' catalogues according to required specifications.</p>
4. Return to service industrial refrigeration systems and	<p>4.1. Components are reassembled and tested for correct operation and assessed against specification.</p> <p>4.2. The system is charged with correct refrigerant</p>

ELEMENT	PERFORMANCE CRITERIA
components	<p>safely and in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>4.3. Using industrial refrigeration principles and system application techniques, correct operation of the equipment is verified.</p> <p>4.4. Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check industrial refrigeration systems and components for correct operation
- comparing system and component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- undertaking calculations and numerical operations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- measuring instruments/equipment, specifications and procedures for checking temperature(s)
- properties of controlled medium(s)

**REQUIRED SKILLS AND KNOWLEDGE**

- measuring instruments/equipment, specifications and procedures for checking components noise and vibration levels
- procedures for reporting non-conformances
- procedures and sequence for performing preventative maintenance on air conditioning systems
- specifications, operational characteristics and process for identifying system components
- process for localising and confirming faulty components
- procedures and all legislative and regulatory requirements for safely removing the refrigerant and charging the system
- procedures for dismantling, repairing, reassembling and testing components
- procedures for selecting replacement parts
- procedures for completing maintenance records/service reports
- hazards and control measures associated with maintaining and repairing industrial refrigeration systems and components
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain and repair industrial refrigeration systems and components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the maintenance and repair of industrial refrigeration systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Controlled medium/s</b>	Process chilling, secondary refrigerants e.g. glycol, brine, air, water, ice etc.
<b>Preventative maintenance tasks</b>	Check/adjust fan belts, check/clean filters,

**RANGE STATEMENT**

	check/clean heat exchangers (evaporator and condenser), overhaul of major system components, cleaning of major system components, testing operation of all safety devices
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18091B Maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers maintaining and repairing multi stage, cascade cryogenic and ultra-cold industrial refrigeration systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>It includes interpreting drawings and diagrams of complex industrial refrigeration systems; utilising fault finding procedures and test equipment to identify and diagnose faults in systems; isolating faulty components; and rectifying common faults.</p> <p>This unit applies to retrofitting existing multi stage, cascade and/or ultra-cold industrial refrigeration systems; reconditioning components; returning to service and testing systems; and completing service reports for administrative action. The application of this competency must cover a variety of refrigeration equipment and systems.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18087B	Service and repair domestic and light commercial refrigeration and air conditioning equipment
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools



Prerequisite units		
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18090B	Maintain and repair industrial refrigeration systems and components
<b>Path 3</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18088B	Maintain and repair commercial air conditioning systems and components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on multi stage, cascade and/or ultra-cold industrial refrigeration systems	<p>1.1.The temperature, pressure and properties of the multi stage, cascade and/or ultra-cold refrigeration system are checked for conformance to specification.</p> <p>1.2.The noise/vibration levels of the multi stage, cascade and/or ultra-cold refrigeration system are checked for conformance to specification.</p> <p>1.3.Preventative maintenance tasks are performed according to manufacturers' specifications using refrigeration techniques/practices.</p>
2. Undertake fault finding on multi stage, cascade and/or ultra-cold industrial refrigeration systems and components	<p>2.1.System components are identified correctly.</p> <p>2.2.The characteristics and operation of each component is understood.</p> <p>2.3.The operational function of each component is inspected and tested.</p> <p>2.4.Correct operation of each component is assessed against specification.</p>
3. Repair/replace faulty components	<p>3.1.Faulty components are localised and malfunction is confirmed by inspection and testing using industrial refrigeration principles, procedures and safety</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>requirements.</p> <p>3.2.The refrigerant is removed safely from the system and contained in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>3.3.Faulty components are dismantled and repaired to manufacturers' specifications as required</p> <p>3.4.Replacement parts are selected from manufacturers' catalogues according to required specifications.</p>
4. Return to service multi stage, cascade and/or ultra-cold refrigeration systems	<p>4.1.Components are reassembled and tested for correct operation and assessed against specification.</p> <p>4.2.The system is charged with correct refrigerant safely and in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>4.3.Using industrial refrigeration principles and system application techniques, correct operation of the equipment is verified.</p> <p>4.4.Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check multi stage, cascade and/or ultra-cold industrial refrigeration systems and components for correct operation
- comparing system, sub-systems and component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken

## REQUIRED SKILLS AND KNOWLEDGE

- documenting results of the adjustments
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information

### Required knowledge

Look for evidence that confirms knowledge of:

- measuring instruments/equipment and specifications for checking the temperature/s and properties of the controlled medium/s
- procedures for reporting non-conformances
- measuring instruments/equipment and specifications for checking component noise and vibration levels
- procedures and sequence for performing preventative maintenance
- procedures and sequence for performing safety equipment checks
- specifications and process for identifying system components
- operational characteristics of the system components
- procedures and all legislative and regulatory requirements for safely removing the refrigerant from the system
- procedures for dismantling and repairing components, selecting replacement parts, reassembling and testing
- procedures for completing maintenance records/service reports
- hazard and control measures associated with maintaining and repairing multi stage, cascade and/or ultra-cold industrial refrigeration systems
- safe work practices and procedures
- calculations and numerical operations within the scope of this unit

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair multi stage, cascade and/or ultra-cold industrial refrigeration systems. Competency

<b>EVIDENCE GUIDE</b>	
	in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the maintenance and repair of multi stage, cascade cryogenic and ultra-cold industrial refrigeration systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
Preventative maintenance tasks	<p>Check/adjust fan belts, check/clean filters, check/clean heat exchangers (evaporator and condenser), overhaul of major system components, cleaning of major system components, testing operation of all safety devices</p>

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Maintenance and diagnostics
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## MEM18092B Maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers repairing or replacing commercial and/or industrial refrigeration and/or commercial air conditioning controls.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the installation, adjustment, repairs, replacements and overhauls undertaken to site or manufacturers' specifications, using application of principles of domestic refrigeration and/or commercial air conditioning control sequencing which may include: PLCs, relay logic control systems, unitised/modular sensors, transducers, timers, counters and associated equipment. System circuit components are identified, traced, inspected and operational function is assessed and verified using refrigeration/air conditioning principles to predetermined specifications, interpreted from data sheets and circuit diagrams. The application of this competency must cover a variety of refrigeration equipment and systems.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a specialisation band A unit and Specialisation band B unit for progression to C7 (AQF level IV).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18088B	Maintain and repair commercial air conditioning systems and components
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems



<b>Prerequisite units</b>		
	MEM18090B	Maintain and repair industrial refrigeration systems and components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Install/replace refrigeration/air conditioning controls	<p>1.1.Refrigeration/air conditioning control principles and system diagrams are interpreted.</p> <p>1.2.Control circuit components are identified and inspected for compliance to specification.</p> <p>1.3.Sequential installation is undertaken according to manufacturers' specifications and standard operating procedures.</p>
2. Check and adjust refrigeration/air conditioning control sequence and operation	<p>2.1.The temperature, quality, pressure and properties of the air delivered by the air conditioning system are checked for conformance to specification.</p> <p>2.2.Controls operation is checked against operational specifications using appropriate test equipment and application principles/techniques.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.3.Adjustments are performed to control sequence to meet/align to operational requirements and specifications.</p> <p>2.4.Modifications/alterations are recorded and reported in accordance with standard operating procedures.</p> <p>2.5.Controls operation is checked and returned to service to specification.</p>
<p>3. Fault find refrigeration/air conditioning control circuits</p>	<p>3.1.Control circuit diagrams and data sheets are interpreted.</p> <p>3.2.Control circuit components are identified and inspected.</p> <p>3.3.Control circuit is traced and action of components is diagnosed to identify and localise faults.</p> <p>3.4.Control circuit parts are tested using appropriate test equipment and application principles.</p> <p>3.5.Control circuit parts are assessed against operational specification.</p> <p>3.6.Fault condition is localised at the component level.</p> <p>3.7.Faulty condition is evaluated, root cause is analysed and corrective action is planned.</p>
<p>4. Maintain, repair/replace control components</p>	<p>4.1.Correct maintenance procedures are applied according to standard operating procedures.</p> <p>4.2.Repair procedures are selected and applied using correct and appropriate techniques, tools and equipment.</p> <p>4.3.Faulty items are tested, repaired or replaced using sequential installation procedures according to manufacturers' specifications.</p> <p>4.4.Replacement items are selected from manufacturers' catalogues to meet specification.</p> <p>4.5.Control components are reassembled using appropriate principles and procedures according to specification.</p>
<p>5. Check and adjust sequence of refrigeration/air conditioning controls</p>	<p>5.1.Sensors and controllers are identified using circuit diagram and refrigeration/air conditioning system control principles.</p> <p>5.2.Necessary adjustments to sequence control circuit are made to meet operational specification.</p> <p>5.3.Correct operation of control circuit is checked and confirmed against operational specification.</p> <p>5.4.Refrigeration/air conditioning controls are returned</p>

ELEMENT	PERFORMANCE CRITERIA
	to service to specification. 5.5. Appropriate follow-up procedures are adopted. 5.6. Service/maintenance report is completed to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- using tools, techniques and equipment necessary to check commercial and/or industrial refrigeration and/or air conditioning controls for correct operation
- comparing system, controls and component performance/operation against specifications
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- planning and sequencing operations
- checking task-related information
- undertaking calculations and numerical operations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- refrigeration/air conditioning system operational requirements and specifications
- application of common system/circuit components and controllers
- the importance of following installation procedures in terms of control operation, safety and reliability
- measuring instruments/equipment and specifications for checking air temperatures, air flows, air quality and air properties

## REQUIRED SKILLS AND KNOWLEDGE

- procedures for reporting non-conformances
- operational sequence of the system
- typical adjustments to correct sequencing variations from specification
- procedures for recording/reporting modifications/alterations/maintenance etc.
- typical causes of component failure
- procedures for rectifying faulty conditions and components
- maintenance requirements
- procedures for returning to service and commissioning refrigeration/air conditioning control systems
- hazards and control measures associated with maintaining and repairing commercial and/or industrial refrigeration and/or air conditioning controls, including housekeeping
- safe workplace practices and procedures
- codes and regulations relevant to the refrigeration / air conditioning industry including environmental and ozone and greenhouse substance legislation

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair commercial and/or industrial refrigeration and/or air conditioning controls. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

## EVIDENCE GUIDE

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the repair/replacement of commercial and/or industrial refrigeration and/or commercial air conditioning controls, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### **Appropriate test equipment**

Pressure gauges, multimeters, ampmeters, megohm meter, analyser

<b>RANGE STATEMENT</b>	
<b>Modifications/alterations</b>	<ul style="list-style-type: none"> <li>Pressure control settings, timer settings, thermostat settings</li> <li>Must comply with manufacturers' specifications, and all changes in site drawings/documents should be documented</li> </ul>
<b>Corrective action</b>	Replacement, repair, adjustment
<b>Maintenance procedures</b>	Overhaul of major system components, cleaning of major system components, testing operation of all control and safety devices

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18093B Maintain and repair integrated industrial refrigeration and/or large air handling system controls

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers repairing/replacing integrated industrial refrigeration and/or air handling system controls.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installation, adjustment, repairs, replacements and overhauls undertaken to site or manufacturers' specifications, using application of principles of industrial refrigeration and/or air handling systems control sequencing which may include: PLCs relay logic control systems, unitised/modular sensors, transducers, timers, counters and associated equipment.</p> <p>In applying this competency, system circuit components are identified, traced, inspected and operational function is assessed and verified using refrigeration/air conditioning principles to predetermined specifications interpreted for data sheets and circuit diagrams. The application of this competency must cover a variety of refrigeration equipment and systems.</p> <p><b>Band: B</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18090B	Maintain and repair industrial refrigeration systems and components
<b>Path 2</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired



Prerequisite units		
		equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18089B	Maintain and repair central air handling systems

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Install/replace refrigeration/air handling system controls	<p>1.1.Refrigeration/air handling control principles and system diagrams are interpreted.</p> <p>1.2.Control system/circuit components are identified and inspected for compliance to specifications.</p> <p>1.3.Sequential installation is undertaken according to manufacturers' specifications and standard operating procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Check and adjust refrigeration/air handling system control sequence and operation	<p>2.1.The temperature, quality, pressure and properties of the air delivered by the air handling system is checked for conformance to specification.</p> <p>2.2.Controls and system operation are checked against operational specifications using appropriate test equipment and application of principles/techniques.</p> <p>2.3.Adjustments are performed to sequence system to meet/align to operational requirements and specifications.</p> <p>2.4.Modifications/alterations are recorded and reported in accordance with standard operating procedures.</p> <p>2.5.Controls and system operation are checked and commissioned to specifications.</p>
3. Fault find refrigeration/air handling system control circuits	<p>3.1.Control system/circuit diagrams and data sheets are interpreted.</p> <p>3.2.Control system/circuit components are identified and inspected.</p> <p>3.3.Control system/circuit is traced and action of components is diagnosed to identify and localise faults.</p> <p>3.4.Control system/circuit parts are tested using appropriate test equipment and application principles.</p> <p>3.5.Control system/circuit parts are assessed against operational specification.</p> <p>3.6.Fault condition is localised at the component level.</p> <p>3.7.Faulty condition is evaluated, root cause is analysed and corrective action is planned.</p>
4. Maintain, repair/replace system control components	<p>4.1.Correct maintenance procedures are applied according to standard operating procedures.</p> <p>4.2.Repair procedures are selected and applied using correct and appropriate techniques, tools and equipment.</p> <p>4.3.Faulty items are tested, repaired or replaced using sequential installation procedures according to manufacturers' specifications.</p> <p>4.4.Replacement items are selected from manufacturers' catalogues to meet specifications.</p> <p>4.5.System control components are reassembled using appropriate principles and procedures according to specification.</p>

ELEMENT	PERFORMANCE CRITERIA
5. Check and adjust sequence of refrigeration/air handling system controls	<p>5.1.Using circuit diagram and refrigeration/air handling system control principles, circuit sensors and controllers are identified.</p> <p>5.2.Necessary adjustments are made to sequence system control circuit to meet operational specification.</p> <p>5.3.Correct operation of system control circuit is checked and confirmed against operational specification.</p> <p>5.4.Refrigeration/air handling system controls are commissioned to specification.</p> <p>5.5.Appropriate follow-up procedures are adopted.</p> <p>5.6.Service/maintenance report is completed to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check integrated industrial refrigeration and/or large air handling system controls for correct operation
- obtaining, reading and interpreting specifications
- comparing system and component/circuit control performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information

## REQUIRED SKILLS AND KNOWLEDGE

- undertaking calculations and numerical operations within the scope of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- safe work practices and procedures
- system operational requirements and specifications
- application of common refrigeration/air handling system components and controllers
- importance of following installation procedures in terms of control operation, safety and reliability
- measuring instruments/equipment and specifications for checking air temperatures, air flows, air quality and air properties
- procedures for reporting non-conformances
- refrigeration/air conditioning test equipment and application
- operational sequence of systems
- typical adjustments to correct sequencing variations from specification
- procedures for recording/reporting modifications/alterations
- typical causes of component failure
- procedures for rectifying faulty conditions
- maintenance schedule and procedures
- common adjustments that can be made to control systems and their effect
- procedures for returning to service or commissioning refrigeration/air handling control systems
- maintenance/service recording/reporting requirements
- hazard and control measures associated with maintaining and repairing integrated industrial refrigeration and/or large air handling system controls, including housekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair integrated industrial refrigeration and/or large air handling system controls.

<b>EVIDENCE GUIDE</b>	
	Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the repair/replacement of integrated industrial refrigeration and air handling systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Test equipment</b>	Multimeter, ammeter, megohm meter, cable analyser, pressure gauges
<b>Adjustments</b>	Pressure controls, timers, thermostats
<b>Modifications/alterations</b>	Pressure control settings, timer settings, thermostat settings. Must comply with manufacturers' specifications. Must be documented in site drawings/documents
<b>Maintenance procedures</b>	Testing of all control sequences, testing of all safety devices
<b>Corrective action</b>	Replacement, repair, adjustment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Maintenance and diagnostics
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# MEM18094B Service and repair commercial refrigeration

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers servicing and repairing commercial and supermarket equipment and components.
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## Application of the Unit

<b>Application of the unit</b>	<p>It includes interpreting drawings and diagrams of refrigeration equipment; utilising basic fault finding procedures, service manifolds, and test equipment to identify and diagnose faults in equipment; isolating faulty components including control components; and rectifying common faults.</p> <p>This unit applies to the service and repair of commercial refrigeration systems. This can include supermarket, retail, wholesale and other commercial applications. This would include service and repair work, reconditioning components, returning to service and testing equipment, and completing service reports for administrative action. It may include retrofitting alternative refrigerants in existing equipment.</p> <p>Where any rectification, modification involves electrical disconnection and reconnection, then Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volt a.c./1500 volt d.c.) should also be considered.</p> <p>When there is a requirement to remove and replace components by brazing and or silver soldering, Unit MEM05006B (Perform brazing and/or silver soldering) should also be accessed.</p> <p>Where detailed maintenance is carried out on control systems, Unit MEM18057B (Maintain/service analogue/digital electronic equipment) should also be selected.</p>
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	<b>Band: A</b> <b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM10002B	Terminate and connect electrical wiring
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18049C	Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, evacuate and charge refrigeration systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks/adjustment on commercial refrigeration equipment	<p>1.1. Visual inspection and testing with appropriate test equipment is carried out according to refrigeration principles, procedures and safety requirements.</p> <p>1.2. Preventative maintenance tasks are performed according to manufacturers' specifications using refrigeration techniques and practices.</p>
2. Undertake fault finding on commercial refrigeration equipment	<p>2.1. Equipment components are identified correctly.</p> <p>2.2. The characteristics and operation of each component is understood.</p> <p>2.3. The operational function of each component is inspected and tested.</p> <p>2.4. Correct operation of each component is assessed against specification.</p>
3. Repair/replace commercial refrigeration components	<p>3.1. Faulty components are localised and malfunction is confirmed by inspection and testing using refrigeration principles, procedures and safety requirements.</p> <p>3.2. The refrigerant is removed safely from the system and contained in accordance with standard operating procedures and regulatory requirements where appropriate.</p> <p>3.3. Faulty components are dismantled and repaired to manufacturers' specifications as required.</p> <p>3.4. Replacement parts are selected from manufacturers' catalogues according to required specifications.</p>
4. Return to service	4.1. Components are reassembled and tested for correct

ELEMENT	PERFORMANCE CRITERIA
commercial refrigeration equipment	<p>operation and assessed against specification</p> <p>4.2.Using refrigeration principles and system application techniques, correct operation of the equipment is verified.</p> <p>4.3.Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking task-related information
- using tools, techniques and equipment necessary to check commercial and supermarket equipment and components for correct operation
- comparing system, controls and component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments
- calculations and numerical operations within the scope of this unit

#### Required knowledge

Look for evidence that confirms knowledge of:

- test procedures
- frequency and reason for preventative maintenance
- variations in component identities
- operation and characteristics of range of components

**REQUIRED SKILLS AND KNOWLEDGE**

- procedures for checking refrigeration components for correct operation
- tools, techniques and equipment necessary to check refrigeration system components
- procedures for identifying components for repair or replacement
- recovery containment and storage procedures for refrigerants
- refrigeration systems evacuation procedures
- effect of poor repair practices
- process to select replacement parts
- assembly and testing procedures
- procedures, tools, techniques and equipment for adjusting refrigeration systems
- procedures for obtaining authorisation of adjustments outside of operational specifications
- codes and regulations relevant to the refrigeration/air conditioning industry, including environmental and ozone and greenhouse substance legislation
- hazards and controls associated with commercial refrigeration, including housekeeping
- safe workplace practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service and repair commercial refrigeration equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of

<b>EVIDENCE GUIDE</b>	
	<p>conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with servicing and repairing commercial and supermarket equipment and components, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Test equipment</b>	Multimeter, ammeter, megohm meter, refrigeration gauge set, vacuum pump, service

<b>RANGE STATEMENT</b>	
	gauges, thermometer etc.
<b>Preventative maintenance tasks</b>	Overhaul of major system components, cleaning of major system components, test operation of all safety devices

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18095A Maintain and repair cooling towers/evaporative condensers and associated equipment

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	The unit covers performing maintenance procedures and/or repairs on cooling towers or evaporative condensers, centrifugal water pumps, valves - including bypass valves, fans, belts and controls to ensure performance to relevant codes and standards.
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### Application of the Unit

<b>Application of the unit</b>	<p>Cooling towers and evaporative condensers form an integral part of the refrigeration system - in commercial, industrial and air conditioning fields. The towers, condensers, centrifugal water pumps, fans, valves and controls comprise the maintenance/repair work skills relevant to this field and must be assessed in this context.</p> <p>Demonstration of competency must be in accordance relevant Australian standards, regulations and codes.</p> <p>Where water treatment only is required, then revised MEM13007B (Maintain water treatment systems for cooling towers) should be considered.</p> <p>Where the refitting or repair/replacement of components involves the fabrication and installation of pipework and assemblies, Unit MEM10010B (Install pipework and pipework assemblies) should be accessed.</p> <p>Where any rectification, modification involves electrical disconnection and reconnection, then Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.) should also be selected.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18094B	Service and repair commercial refrigeration
<b>Path 2</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements



Prerequisite units		
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems
	MEM18088B	Maintain and repair commercial air conditioning systems and components

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventive maintenance checks	1.1. Legislative requirements are understood. 1.2. System components are identified. 1.3. The operational function of each component is

ELEMENT	PERFORMANCE CRITERIA
	<p>inspected and tested.</p> <p>1.4. Correct operation of each component is assessed against specification.</p> <p>1.5. Visual inspection and testing with appropriate test equipment is carried out according to refrigeration principles, procedures and safety requirements.</p> <p>1.6. Preventative maintenance tasks are performed to manufacturers' specifications using refrigeration techniques and practices.</p>
2. Undertake fault finding on cooling tower/evaporative condenser water systems components	<p>2.1. System components are identified correctly.</p> <p>2.2. The characteristics and operation of each component is understood.</p> <p>2.3. The operational function of each component is inspected and tested.</p> <p>2.4. Correct operation of each component is assessed against specification.</p>
3. Repair/replace cooling tower/evaporative condenser components	<p>3.1. Faulty components are localised and malfunction is confirmed by inspection and testing using refrigeration principles, procedures and safety requirements.</p> <p>3.2. Faulty components are dismantled and repaired to manufacturers' specifications as required.</p> <p>3.3. Replacement parts are selected from manufacturers' or other catalogues according to required specifications.</p> <p>3.4. Where required, refrigerant is removed/contained following refrigeration principles and procedures to all relevant standards, codes and safety standards.</p>
4. Return to service cooling tower/evaporative condenser components.	<p>4.1. Components are reassembled and tested for correct operation and assessed against specification.</p> <p>4.2. Where required, refrigerant is added to system, following refrigeration principles and procedures to all relevant standards, codes and safety standards.</p> <p>4.3. Using refrigeration principles and system application, correct operation of the equipment is verified.</p> <p>4.4. Maintenance records/service reports are completed by appropriate designated means.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check cooling tower/evaporative condenser fans, valves, centrifugal pumps and components for correct operation
- obtaining and interpreting specifications
- comparing system and component performance/operation against specification
- identifying faulty components and non-compliances
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- removing and replacing refrigerant
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments

#### Required knowledge

Look for evidence that confirms knowledge of:

- terminology of cooling towers
- psychometrics
- measuring instruments/equipment, specifications and procedures for checking temperature(s)/humidity/air flow
- operation of centrifugal water pumps
- terminology of centrifugal water pumps
- field testing centrifugal pumps
- operation of water valves including bypass valve either mechanical or electrical operation
- procedures for testing and operation of controls
- procedures for testing of fan motors
- v belts
- measuring instruments/equipment, specifications and procedures for checking component noise and vibration levels
- procedures for reporting non-conformances
- procedures and sequence for performing preventative maintenance on refrigeration and air conditioning systems
- specifications, operational characteristics and process for identifying system components
- process for localising and confirming faulty components

## REQUIRED SKILLS AND KNOWLEDGE

- procedures and all legislative and regulatory requirements for safely removing the refrigerant and charging the system
- procedures for dismantling, repairing, reassembling and testing components
- procedure for removal/recharging refrigerant
- procedures for selecting replacement parts
- procedures for completing maintenance records/service reports

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to maintain and repair cooling towers and/or evaporative condensers, fans, centrifugal water pumps, valves and control equipment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the maintenance and repair of cooling

<b>EVIDENCE GUIDE</b>	
	towers/evaporative condensers /pumps/ fans or valves, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Components</b>	Fan motor, fan blade, pump, pump motor, sprays, condenser, valves (bypass, shut-off, temperature control valves), thermostat, drift eliminators, v belt, water strainer
<b>Operational</b>	How it works
<b>Test equipment</b>	Sling psychrometer, thermometer, refrigeration gauges, vacuum pump, leak detector, multimeter, insulation resistance tester, assorted hand tools
<b>Manufacturers' specifications</b>	Details supplied by manufactures

<b>RANGE STATEMENT</b>	
<b>Characteristics</b>	The design and installation of the particular component
<b>Malfunction</b>	Could be a fault in any of the components
<b>Application</b>	Type of installation or equipment

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18096A Maintain, repair/replace and adjust refrigerant flow controls and associated equipment

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing the selection, maintenance, repair/replacement and adjustment of refrigerant flow controls, either liquid or vapour (mechanical or electronic types) to achieve desired operational performance.
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### Application of the Unit

<b>Application of the unit</b>	<p>The selection, maintenance, repair, replacement and adjustment of refrigerant flow controls are conducted according to refrigeration principles and practices. Adjustments are made to manufacturers' specifications. All work is conducted according to safety regulations and Australian standards and codes.</p> <p>The associate equipment may include controllers and/or valves required to ensure proper operation of the flow device.</p> <p>Where any rectification, modification involves electrical disconnection and reconnection, then Unit MEM18049C (Disconnect/reconnect fixed wired equipment up to 1000 volts a.c./1500 volts d.c.) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM10010B	Install pipework and pipework assemblies
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18086B	Test, recover, evacuate and charge refrigeration systems

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Undertake preventative maintenance checks on refrigerant flow controls	<p>1.1.The location and operation of the control is understood.</p> <p>1.2.The operational parameters of the refrigerant control are understood.</p> <p>1.3.Visual inspection and testing with appropriate test equipment is carried out by following refrigeration principles, procedures and safety requirements.</p> <p>1.4.The refrigerant type is correctly identified.</p>
2. Undertake fault finding on refrigerant flow controls	<p>2.1.Flow control is identified correctly.</p> <p>2.2.The characteristics of the flow control are understood.</p> <p>2.3.The operational function of the flow control and associated valves are inspected and tested.</p> <p>2.4.Appropriate test equipment can be selected/used safely.</p> <p>2.5.Correct operation of the flow control is assessed against specification.</p>
3. Repair or replace refrigerant flow control	<p>3.1.Using manufacturers' catalogues and specifications, appropriate flow control or components relevant to system operation are selected for replacement/repair.</p> <p>3.2.The refrigerant is removed/contained safely from the system in accordance with refrigeration principles and procedures and relevant standards and codes.</p> <p>3.3.Faulty components are dismantled and repaired /replaced to manufactures' specifications as required.</p> <p>3.4.Replacement parts are selected from manufactures catalogues according to required specifications.</p>
4. Return to service refrigerant flow control	<p>4.1.System is evacuated and recharged with refrigerant safely, in accordance with refrigeration principles and procedures and relevant standards and codes.</p> <p>4.2.System is leak tested in accordance with refrigeration principles/procedures and relevant standards and codes.</p> <p>4.3.Flow control is adjusted to manufactures' specifications in accordance with refrigeration principles and procedures and relevant standards and codes.</p> <p>4.4.Performance check is undertaken in accordance with refrigeration principles and procedures and relevant standards and codes.</p>

ELEMENT	PERFORMANCE CRITERIA
	4.5.Maintenance records service reports are completed by appropriate designated means.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using tools, techniques and equipment necessary to check for correct operation
- obtaining and interpreting specifications
- comparing system and component performance/operation against specification
- select replacement controls and/or components
- identifying faulty components and non-compliances
- using appropriate test equipment to identify non-compliance
- safely remove, contain or add refrigerant to relevant Australian standards or codes
- making required adjustments to achieve specifications
- sourcing and using relevant catalogues/lists
- applying safety procedures, standard operating procedures and legislative requirements to all work undertaken
- documenting results of the adjustments

#### Required knowledge

Look for evidence that confirms knowledge of:

- operation of refrigerant flow controls including:
  - TEV
  - internal equalised
  - external equalised
  - direct operating
  - servo operated
  - pilot operated
- MOP
- cross charged
- gas charged
- capillary tube

## REQUIRED SKILLS AND KNOWLEDGE

- thermo electric
- electronic TEV and controllers
- low side floats
- high side floats
- distributors
- reversing valves
- solenoid valves
- non return valves
- EPR
- CPR
- condenser bypass valves
- liquid level controllers
- AX valves
- hand expansion valves
- measuring instruments/equipment, specifications and procedures for checking temperature(s)
- measuring instruments/equipment, specifications and procedures for checking components
- procedures for reporting non-conformances
- procedures and sequence for performing preventative maintenance
- specifications, operational characteristics and process for identifying system components
- process for localising and confirming faulty components
- process for identifying refrigerant type
- procedures and all legislative and regulatory requirements for safely removing the refrigerant and charging the system
- procedures for dismantling, repairing, reassembling and testing components
- procedures for selecting replacement parts
- procedures for completing maintenance records/service reports

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to maintain, adjust, repair or replace refrigerant flow controls, either liquid or vapour, to manufactures' specifications safely to relevant Australian standards codes and regulations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the maintenance, repair/replacement or adjustment of refrigerant flow controls, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Control</b>	Selected from required knowledge list
<b>Parameters</b>	Operational values
<b>Refrigerant control</b>	Could be any selected from list in required knowledge
<b>Characteristics</b>	Operational parameters of the flow control
<b>Associated valves</b>	Check valves, solenoid valves
<b>Test equipment</b>	Refrigeration gauges, thermometers, multimeter, vacuum pump, leak detector, associated hand tools, specialised hand tools
<b>Components</b>	Any part of any flow control selected from list in required knowledge
<b>Performance</b>	Pressures, temperatures and relationships

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Maintenance and diagnostics
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## MEM18097A Manufacture cavity dies

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing to manufacture and manufacturing cavity dies including matching use of hand and hand held power tools, assembly of the tooling components and trialling the tooling.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit includes the skills required to manufacture and trial all types of production tooling.</p> <p>Work is undertaken autonomously or in a team environment.</p> <p>The tooling being produced may include, but is not limited to, the following types:, forging dies, extruding dies, die casting (high and low pressure and gravity feed), plastic moulds (injection, compression, blow and foam) and glass moulds or dies requiring precision manufacture. A normal range of tool room equipment would be used which may include lathes, mills, copy/duplicator, grinders, EDM and wire cut equipment, precision measurement, hand and power tools.</p> <p>Where simple welding or brazing skills are required, see Units MEM05012C (Perform routine manual metal arc welding) and Unit MEM05006B (Perform brazing and/or silver soldering). Where manufacture of press tools and gauges is required, unit MEM18014B (Manufacture press tools and gauges) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing
	MEM07005C	Perform general machining
	MEM07006C	Perform lathe operations
	MEM07007C	Perform milling operations
	MEM07008D	Perform grinding operations
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform recision mechanical measurement
	MEM12006C	Mark off/out (general engineering)
	MEM12023A	Perform engineering measurements
	MEM12024A	Perform computations
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18006C	Repair and fit engineering components
	MEM18015B	Maintain tools and dies
	MEM18055B	Dismantle, replace and assemble engineering components



<b>Prerequisite units</b>		
	MEM30012A	Use mathematical techniques and perform simple statistical computations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare to manufacture cavity die	<p>1.1.Tooling requirements are determined from customer's components drawings, prints or sample component.</p> <p>1.2.Tooling type and design are conceptualised and planned with reference to customer's specifications (written or verbal) for numbers, finish, quality and material.</p> <p>1.3.Production machine to be used to produce components is assessed and considered in tooling design.</p> <p>1.4.Tool design is interpreted and visualised from tooling drawings, prints or plan and checked against customer requirements.</p> <p>1.5.Selected production machine mounting requirements</p>

ELEMENT	PERFORMANCE CRITERIA
	are determined to ensure any special or additional provisions are incorporated in tooling design.
2. Manufacture tooling	<p>2.1.Appropriate materials are selected and obtained to meet tooling requirements for strength, durability, component finish, heat treatment qualities where necessary and accounting for materials availability.</p> <p>2.2.Selected material is tested for hardness as appropriate to aid selection of machine tools, hand tools and hand held power tools to be used to fashion or shape tooling components.</p> <p>2.3.Plan is developed to sequence and stage manufacturing process, including establishing datum, mark out, rough out (machine or fashion), stress relieve/heat treat, finish size, fashion and fit and assemble componentry.</p>
3. Perform machining operations	3.1.Appropriate machines and machining process are selected from a range of standard tool room machines to shape/produce tooling components to specifications.
4. Use hand and hand held power tools	<p>4.1.A range of hand and hand held power tools are selected and used to fashion/manufacture tooling components to specification.</p> <p>4.2.Where practical, components sample or section is produced for testing.</p>
5. Assemble tooling components	5.1.Using acceptable tool making techniques and procedures, components are checked and fitted/assembled correctly to specifications.
6. Trial tooling	<p>6.1.First-off component is checked with precision instruments against specification.</p> <p>6.2.Tooling is modified as necessary to produce components to specification.</p> <p>6.3.Modified tooling is re-trialled and component is produced.</p> <p>6.4.Conformance to specification is verified and reported according to standard operating procedures.</p> <p>6.5.Where necessary, all deviations or modifications to original tooling design, prints or plans are recorded and reported according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant drawings, prints and/or sample components, specifications and instructions
- sketching or drawing the tool design
- incorporating mounting requirements into tooling design
- testing tooling materials for hardness
- preparing sequential plan for the manufacture of the required tooling
- shaping/producing tooling components to specifications using appropriate machines and machining processes
- using hand and hand held power tools to fashion/ manufacture tooling components to specification
- assembling and fitting tooling components using acceptable tool making techniques and procedures
- producing first-off component/product
- checking first-off component/product for conformance to specification
- modifying tooling using appropriate tool making techniques and procedures
- checking conformance of the component/product to specifications
- recording/reporting modifications or alterations to original tooling design

#### Required knowledge

Look for evidence that confirms knowledge of:

- customers' tooling requirements
- the type of tooling to be manufactured
- the machine(s) in which the tooling is to be used
- the tooling design concept in terms of customer specifications and proposed production machine(s)
- the performance requirements of the tooling
- the method of mounting the tooling in the production machine into which it is to be installed
- the physical properties of a range of tool steels
- the appropriate materials for each component of the tooling to be produced
- the reasons for selecting the chosen materials in terms of: strength, durability, component finish, heat treatment requirements, and availability
- the procedures for hardness testing materials
- the effect of material hardness on machinability of the material
- the appropriate machinery and tools to be used to fashion or shape tooling

**REQUIRED SKILLS AND KNOWLEDGE**

components

- the reasons for selecting the chosen machinery and tooling
- the reasons for establishing a sequential plan for the manufacture of tooling
- the procedures for documenting plans for the manufacture of tooling
- the hand and hand held power tools to be used to fashion/manufacture the required tooling components
- the reasons for selecting the chosen hand and hand held power tools
- procedures for fitting/assembling the tooling components
- the precautions to be taken when fitting/assembling tooling components
- the appropriate precision instruments for checking the components produced
- the specifications of the finished product
- causes of any non-conformance to specification
- the tool making techniques/procedures to be applied to return the tooling to specification
- procedures for reporting/recording the conformance of the component/product produced by the tooling to specifications
- procedures for recording/reporting modifications and/or alterations to tooling design
- hazards and control measures associated with the manufacture of tools, including housekeeping
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to manufacture cavity dies. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with cavity die manufacture or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**RANGE STATEMENT****Tooling**

Forging dies, extruding dies, die casting (high and low pressure and gravity feed), plastic moulds (injection, compression, blow and foam) and glass moulds or dies requiring precision manufacture

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Maintenance and diagnostics

## MEM18098A Prepare to perform work associated with fuel system installation and servicing

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency covers the skills and knowledge required to prepare for work associated with fuel system installation and servicing. It complements other relevant general occupational health and safety (OHS) and any required technical units.

### Application of the Unit

This unit applies to personnel who install or service fuel systems and equipment. They will typically undertake this in a service station forecourt which may be operational or be shut down for refurbishment or under construction.

Work associated with installation and servicing may be undertaken by a person working autonomously or in a team.

The skills and knowledge needed to undertake the work are covered by relevant technical units of competency.

Band: A

Unit weight: 2

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM09002B	Interpret technical drawing
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## Employability Skills Information

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| 1 Plan and prepare for installation or servicing task       | 1.1 Clarify job requirements, as appropriate<br>1.2 Clarify variations to work plan and take appropriate action<br>1.3 Obtain required work permits<br>1.4 Identify and comply with emergency and safety procedures for worksite   |
| 2 Confirm location and nature of key fuel system components | 2.1 Identify and locate above and below ground storage components<br>2.2 Identify and locate fuel conveying systems<br>2.3 Identify and locate pumps and pump systems<br>2.4 Identify and locate dispensing systems<br>2.5 Confirm location of fuel system components with site plan<br>2.6 Identify and report any hazards and/or inconsistencies with site plan, equipment drawings and regulatory requirements                              |
| 3 Assess and manage risks associated with the work          | 3.1 Identify fuels and other hazardous materials on site<br>3.2 Identify other hazards<br>3.3 Identify and confirm shut-off procedures, details of evacuation plan and location of emergency equipment<br>3.4 Assess hazards and determine risks<br>3.5 Determine appropriate control measures to control risks<br>3.6 Select appropriate tools and equipment to be used on the job<br>3.7 Identify nature and location of required isolations |



- 3.8 Determine the type of, and appropriate locations for, barriers to prevent unauthorised access to the work location and put them in place before job commencement

## Required Skills and Knowledge

Required knowledge includes:

- types of fuels and their associated hazards
- fuel delivery systems and associated hazards:
  - pressure
  - suction
  - flammability
  - explosive potential
  - toxicity
  - static electricity
- dangerous goods classification and labelling
- storage and handling of dangerous goods
- suction/pressure systems
- first stage vapour recovery systems
- second stage vapour recovery systems
- pumps and pumping principles and problems
- fuel dispensing and metering systems
- interpretation of permits, site maps and hazard maps
- regulatory requirements, including licensing, OHS and environmental regulations

Required skills include:

- communicating effectively, including recording, reporting and documenting information
- identifying and complying with appropriate legislation and regulations
- identifying hazards
- assessing hazards and determining risks
- determining appropriate control measures using the hierarchy of control
- identifying support and assistance requirements
- relating to people from a range of social, cultural and ethnic backgrounds and of varying physical and mental abilities
- selecting and using appropriate personal protection equipment
- using relevant computer systems

## Evidence Guide

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>determine work requirements</li> <li>identify hazards and risks associated with the worksite</li> <li>establish appropriate plan for the performance of work</li> <li>apply any state/territory licensing, OHS and environmental legislation, standards and industry codes of practice.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>The application of competency may be assessed in the workplace or simulated work environment.</li> <li>Assessment may be conducted before a candidate goes to site using appropriate simulations, scenarios and questioning.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>The assessment environment should not disadvantage the candidate.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required.</li> <li>The following resources should be made available: <ul style="list-style-type: none"> <li>workplace location or simulated workplace</li> <li>a bank of appropriate scenarios.</li> </ul> </li> </ul>
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and suitable to the language, literacy and numeracy capacity of the candidate and the competency being assessed. In all cases where practical assessment is used, it should be combined with targeted questioning to assess the underpinning knowledge.</p>

## Range Statement

<b>Work permits</b>	<p>Work permits may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• permits issued by client</li><li>• permits using the Australian Institute of Petroleum (AIP) form</li><li>• other work documents required for the job</li></ul> <p>Types of permit may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• hot work</li><li>• cold work</li><li>• confined space</li><li>• excavation</li><li>• working at heights</li></ul>
<b>Emergency and safety procedures for worksite</b>	<p>Emergency and safety procedures for worksite may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• specific procedures for that site</li><li>• location of emergency shut-off and procedures for re-setting emergency shut-off</li><li>• dealing with spills or other losses in containment</li><li>• fire response</li><li>• other incident response procedures for that site</li><li>• other site-specific hazards and procedures</li></ul>
<b>Storage components</b>	<p>Storage components may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• single wall tanks</li><li>• jacketed steel tanks</li><li>• double-walled tanks (dry and liquid filled interstitial space)</li><li>• fibre composite (FRP) tanks</li><li>• high density polyethylene (HDPE) tanks</li></ul>
<b>Fuel conveying systems</b>	<p>Fuel conveying systems may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• steel pipes</li><li>• HDPE pipes</li><li>• vapour recovery systems and pipes</li><li>• pipe joining</li></ul>
<b>Pumps and pump systems</b>	<p>Pumps and pump systems may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• centrifugal pumps</li><li>• positive displacement pumps</li><li>• pressure and suction systems</li><li>• pumping problems</li><li>• multiproduct pumps</li></ul>

<b>Dispensing systems</b>	<p>Dispensing systems may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• fuel metering</li> <li>• hoses and nozzles</li> <li>• stage two vapour recovery</li> <li>• flow control valves</li> <li>• discharge control</li> <li>• multiproduct dispensers</li> </ul>
<b>Corrosion protection systems and components</b>	<p>Corrosion protection systems and components may be:</p> <ul style="list-style-type: none"> <li>• cathodic protection: <ul style="list-style-type: none"> <li>• impressed current</li> <li>• sacrificial anode</li> </ul> </li> <li>• wrapping</li> <li>• coating</li> </ul>
<b>Fuels</b>	<p>Fuels may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• petrol</li> <li>• ethanol blend fuels (of various concentrations)</li> <li>• diesel and biodiesel</li> <li>• liquefied petroleum gas (LPG)</li> </ul>
<b>Hazardous materials</b>	<p>Other hazardous materials may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• ‘solid’ pool chlorine (calcium hypochlorite)</li> <li>• ‘liquid’ pool chlorine (sodium hypochlorite solutions)</li> <li>• lubricants</li> <li>• cleaning agents</li> <li>• gas ‘bottles’</li> <li>• workshop materials</li> </ul>
<b>Appropriate tools</b>	<p>Appropriate tools may include, but are not limited to tools that are:</p> <ul style="list-style-type: none"> <li>• intrinsically safe</li> <li>• ergonomically appropriate to the job</li> <li>• safe and in good condition</li> </ul>
<b>Required isolations</b>	<p>Required isolations may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lock out/tag out</li> <li>• double block and bleed</li> <li>• use of blanks, blinds and goggles</li> <li>• removal of spool piece</li> <li>• removal of mechanical drives</li> </ul>

<b>Barriers</b>	Barriers are methods of excluding unauthorised access from the worksite and may include, but are not limited to: <ul style="list-style-type: none"><li>• temporary fencing</li><li>• bollards</li><li>• witches hats</li><li>• tapes</li><li>• signage</li></ul>
<b>Problems</b>	Typical problems may include, but are not limited to: <ul style="list-style-type: none"><li>• variations to the work schedule</li><li>• variations to the work scope</li><li>• issues with the public or site personnel</li><li>• failure of equipment</li><li>• inappropriate/incomplete permit or work instructions</li></ul>

## Unit Sector(s)

Maintenance and diagnostics

## Custom Content Section

Not applicable.

## MEM19001B Perform jewellery metal casting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers casting jewellery primarily by the 'lost wax' method of investment casting.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to jewellery metal casting, primarily by the 'lost wax' method of investment casting, but may include cuttlebone and sand processes as extensions.</p> <p>It may apply in a jewellery manufacturing or casting environment.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13004B	Work safely with molten metals/glass

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare metals for casting	1.1. Metals and alloys are selected in appropriate proportions. 1.2. Metals and alloys are weighed out correctly and in correct wax-to-metal ratios. 1.3. Relevant data is recorded.
2. Conduct pre-casting operations	2.1. Equipment is prepared according to standard operation procedures. 2.2. Inert gas supply/delivery and vacuum systems are checked, if applicable. 2.3. Preheating/glazing is carried out, if applicable. 2.4. Temperature of invested flask is maintained.
3. Melt jewellery metal	3.1. Protective coating is applied to jewellery metal as appropriate. 3.2. Jewellery metal is heated. 3.3. Jewellery metal casting temperature is achieved.
4. Cast metals	4.1. Burn-out flask is positioned correctly. 4.2. Molten metal is tapped. 4.3. Allowance is made for adequate solidification time. 4.4. Furnace is operated in accordance with work site procedures.
5. Perform post-casting	5.1. Casting flask is removed and stored in a safe manner.

ELEMENT	PERFORMANCE CRITERIA
operations	5.2.Casting materials/consumables are cleaned/stored/disposed as appropriate.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying metals and their alloys
- weighing metals and their alloys
- setting up, checking and operating equipment
- maintaining furnace temperatures
- heating metals and alloys
- applying safe casting procedures
- working within heating timeframe constraints
- housekeeping
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings

#### Required knowledge

Look for evidence that confirms knowledge of:

- hazards related to casting
- safety clothing/apparatus for casting
- identification of precious metals and alloys
- calculations for proportions/quantities of alloys
- data recording procedures
- consequences of poor work practices
- equipment preparation and operating procedures
- burn-out cycles and testing of heat register/control device
- procedures for checking and maintaining inert gas supply/delivery seals and vacuum systems
- melting points of various metals/alloys
- furnace start-up and shut-down procedures
- housekeeping and equipment cleaning procedures



**REQUIRED SKILLS AND KNOWLEDGE**

- safe work practices and procedures
- properties of jewellery metals in relation to casting

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to cast jewellery items using investment, vacuum/centrifugal casting procedures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with jewellery metal casting or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples

**EVIDENCE GUIDE**

	and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Metals and alloys</b>	Gold, platinum, palladium, silver, copper, and their alloys
<b>Equipment</b>	Resistance/induction coils, and hand held torches fuelled by a variety of combinations of gas/propane/acetylene/air/oxygen
<b>Protective coating</b>	Protective coatings may include borax, fluxes and inert gases

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Jewellery and horological
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## MEM19002B Prepare jewellery illustrations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing jewellery illustrations using manual and electronic procedures and equipment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the development of jewellery illustrations used for practical application, such as manufacturing, modifying or repairing jewellery items.</p> <p>Illustrations could be developed using manual and electronic procedures and equipment. Where a CAD system is used, the appropriate units should also be selected.</p> <p>Illustrations would typically be based on customer and/or work instructions and associated documents.</p> <p>Where interpersonal and customer/client service skills are required, the appropriate units should also be considered.</p> <p>Where computerised storage and retrieval systems are used, Unit MEM16008A (Interact with computing technology) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16006A	Organise and communicate information

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify drawing specifications	1.1.Specifications are identified from appropriate sources. 1.2.Required data is identified and collected. 1.3.Appropriate equipment is selected.
2. Prepare or modify drawing	2.1.Illustrations are consistent with enterprise standard operating procedures. 2.2.Illustration is rendered, if applicable. 2.3.Illustration and accompanying documentation are approved in accordance with standard operating procedures.
3. File/store of illustration	3.1.Working and reference drawings/illustrations are used/stored/filed/copied/issued in accordance with

ELEMENT	PERFORMANCE CRITERIA
	standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying and collecting data necessary to produce the illustration
- selecting equipment appropriate to the illustrating method and requirements
- using colour, contour, shadow/highlight techniques for emphasis to display jewellery design concept
- interpreting and clarifying illustration requirements
- drawing and rendering
- modifying drawings

#### Required knowledge

Look for evidence that confirms knowledge of:

- common documentation, storage and retrieval
- isometric and orthographic drawing perspectives
- drawing equipment and applications, storage and maintenance
- drawing methods
- rendering applications and techniques and tools for the creation of illustration effects
- jewellery designs - e.g. shanks, settings styles, shoulders, decorative finishes
- working properties of jewellery metals used in practical manufacturing applications

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare jewellery illustrations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing jewellery illustrations or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Specifications</b>	Design information, customer ideas/ concepts/ expectations/requirements, sketches, preliminary layouts, work instructions, job packets and associated documents
<b>Required data</b>	Material, dimensions, stone sizes, customer sizing, special requests e.g. engraving
<b>Appropriate equipment</b>	Compass, set square, ruler, range of graphite/colour pencils, cartridge paper
<b>Accompanying documentation</b>	Quotation, specific design information and recommendations

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	



## Competency field

Competency field	Jewellery and horological
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## MEM19003B Handle gem materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers handling and examining gem materials during jewellery manufacture, repair or alteration to minimise the risk of damage to gem materials (including diamonds).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to handling of gem materials to minimise risk of damage, through familiarity and understanding of the physical and chemical properties of natural, composite, synthetic, imitation and treated gem materials that may affect handling requirements.</p> <p>Emphasis is placed on knowledge of the principles of gemology, gemstone and diamond nomenclature, gemstone processing enhancement and repair, and appreciation of gemstone qualities.</p> <p>This unit applies to an individual working autonomously in a jewellery manufacturing environment and guided by strict rules of procedure.</p> <p>Equipment would include 10x loupe, tweezers and thermal probes.</p> <p>The range of gem materials would include all natural, synthetic, treated, composite and imitation gem materials that may reasonably be expected to be encountered in the workplace.</p> <p><b>Note:</b> The competencies covered by this unit do not include the requirement to perform accurate and positive gemstone identifications.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM19003B	Handle gem materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare equipment for gemstone examination	1.1.Examination methods and <i>equipment</i> are selected appropriate to the gem material and examination requirements.

ELEMENT	PERFORMANCE CRITERIA
	1.2. Equipment and specimen/s are prepared.
2. Perform gemstone examinations	2.1. The physical and optical properties of gem materials are observed. 2.2. Examination results are recorded and verified.
3. Handle gem materials	3.1. Handling measures appropriate to gem material are identified. 3.2. Gem materials are handled to minimise risk of damage.
4. Investigate and report examination results	4.1. Examination results are prepared and recorded.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard work procedures, charts, lists, illustrations and other applicable reference documents
- checking and clarifying task-related information
- entering task-related information onto proformas and workplace documents
- selecting procedures and equipment for examination of gem materials
- preparing, pre-setting, balancing, calibrating, and levelling equipment
- cleaning specimens
- using equipment according to manuals and standard operating procedures
- identifying relevant physical and optical properties of gemstones
- recording results and comparing results with known control items/charts/lists/graphs/diagrams and resource materials
- reading valuation documents and making comparisons
- verifying outcomes
- selecting and applying handling measures and precautions in relation to given gem materials, work processes and tools/equipment
- preparing format/documentation of results according to standard operating procedures.
- interpreting results

## REQUIRED SKILLS AND KNOWLEDGE

- obtaining sufficient evidence to support conclusions
- undertaking numerical operations and calculations/formulae within the scope of this unit
- following verbal instructions

### Required knowledge

Look for evidence that confirms knowledge of:

- examination methods for gem materials in relation to the properties and features that may affect specific materials during jewellery manufacture, repair or alteration
- equipment required for examination and the function of each
- limitations of the selected equipment/methods
- standard operating procedures and supplier/manufacture specifications
- the procedures for correct use of selected equipment
- definitions of processes and features
- physical and optical properties of relevant gemstones
- the process for verifying results
- resource materials
- handling measures and precautions for specific gem materials during jewellery manufacture, repair or alteration
- specific handling measures and precautions used during given jobs
- evidence used in support of conclusions
- terminology and definitions
- limitations/errors in process/methods
- sources of independent verification
- hazards and control measures associated with handling gem materials, including housekeeping
- the effects of inadequate housekeeping and workplace procedures
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to handle and examine gemstone materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with handling and examining gemstone materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Equipment

- Refractometer
- UV light
- Microscope
- 10 X loupe
- Tweezers

#### Investigate

- Assess need for further examination
- Cross reference other records
- Cross reference valuation documents

## Unit Sector(s)

### Unit sector

## Co-requisite units

Co-requisite units		

## Competency field

### Competency field

Jewellery and horological





## MEM19004B Handle and examine gemstone materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers handling and examining gem materials during jewellery manufacture, repair or alteration to minimise the risk of damage to gem materials (including diamonds).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to handling of gem materials to minimise risk of damage, through familiarity and understanding of the physical and chemical properties of natural, composite, synthetic, imitation and treated gem materials that may affect handling requirements.</p> <p>Emphasis is placed on knowledge of the principles of gemology, gemstone and diamond nomenclature, gemstone processing enhancement and repair, and appreciation of gemstone qualities.</p> <p>This unit applies to an individual working autonomously in a jewellery manufacturing environment and guided by strict rules of procedure.</p> <p>Equipment would include 10x loupe, tweezers and thermal probes.</p> <p>The range of gem materials would include all natural, synthetic, treated, composite and imitation gem materials that may reasonably be expected to be encountered in the workplace.</p> <p><b>Note:</b> The competencies covered by this unit do not include the requirement to perform accurate and positive gemstone identifications.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM19003B	Handle gem materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare equipment for gemstone examination	1.1.Examination methods and <i>equipment</i> are selected appropriate to the gem material and examination requirements.

ELEMENT	PERFORMANCE CRITERIA
	1.2. Equipment and specimen/s are prepared.
2. Perform gemstone examinations	2.1. The physical and optical properties of gem materials are observed. 2.2. Examination results are recorded and verified.
3. Handle gem materials	3.1. Handling measures appropriate to gem material are identified. 3.2. Gem materials are handled to minimise risk of damage.
4. Investigate and report examination results	4.1. Examination results are prepared and recorded.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard work procedures, charts, lists, illustrations and other applicable reference documents
- checking and clarifying task-related information
- entering task-related information onto proformas and workplace documents
- selecting procedures and equipment for examination of gem materials
- preparing, pre-setting, balancing, calibrating, and levelling equipment
- cleaning specimens
- using equipment according to manuals and standard operating procedures
- identifying relevant physical and optical properties of gemstones
- recording results and comparing results with known control items/charts/lists/graphs/diagrams and resource materials
- reading valuation documents and making comparisons
- verifying outcomes
- selecting and applying handling measures and precautions in relation to given gem materials, work processes and tools/equipment
- preparing format/documentation of results according to standard operating procedures.
- interpreting results

**REQUIRED SKILLS AND KNOWLEDGE**

- obtaining sufficient evidence to support conclusions
- undertaking numerical operations and calculations/formulae within the scope of this unit
- following verbal instructions

**Required knowledge**

Look for evidence that confirms knowledge of:

- examination methods for gem materials in relation to the properties and features that may affect specific materials during jewellery manufacture, repair or alteration
- equipment required for examination and the function of each
- limitations of the selected equipment/methods
- standard operating procedures and supplier/manufacturer specifications
- the procedures for correct use of selected equipment
- definitions of processes and features
- physical and optical properties of relevant gemstones
- the process for verifying results
- resource materials
- handling measures and precautions for specific gem materials during jewellery manufacture, repair or alteration
- specific handling measures and precautions used during given jobs
- evidence used in support of conclusions
- terminology and definitions
- limitations/errors in process/methods
- sources of independent verification
- hazards and control measures associated with handling gem materials, including housekeeping
- the effects of inadequate housekeeping and workplace procedures
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to handle and examine gemstone materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with handling and examining gemstone materials or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Equipment</b>	<ul style="list-style-type: none"> <li>• Refractometer</li> <li>• UV light</li> <li>• Microscope</li> <li>• 10 X loupe</li> <li>• Tweezers</li> </ul>
<b>Investigate</b>	<ul style="list-style-type: none"> <li>• Assess need for further examination</li> <li>• Cross reference other records</li> <li>• Cross reference valuation documents</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Jewellery and horological
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## MEM19005B Produce three-dimensional precision items

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing one-off, three-dimensional handmade jewellery items using a range of metals and techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of one-off three-dimensional precision jewellery items including rings, pendants, brooches, earrings, bracelets and other decorative pieces from metals common to industry practice.</p> <p>Where lathes are used, Unit MEM07005C (Perform general machining) should also be selected. Where soldering is required, Unit MEM05006B (Perform brazing and/or silver soldering) should also be selected. Production of three-dimensional precision jewellery masters is covered by Unit MEM19013B (Prepare jewellery metal masters).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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### Licensing/Regulatory Information

Not Applicable



## Pre-Requisites

Prerequisite units		
Path 1	MEM13003B	Work safely with industrial chemicals and materials
	MEM13004B	Work safely with molten metals/glass
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine item requirements	1.1.Item production information is identified. 1.2.Process/technique is selected for production of item. 1.3.Item material/s is selected. 1.4.Appropriate tools, equipment and processes are

ELEMENT	PERFORMANCE CRITERIA
	selected.
2. Produce one-off design/item	2.1.Construction plan is developed to meet specifications/stages of process. 2.2.Item components are prepared using appropriate techniques/procedures. 2.3.Design/item is produced/assembled.
3. Finish and inspect work	3.1.Item is checked for compliance with specifications. 3.2.Product data is recorded using appropriate documentation. 3.3.Final finish and storage procedures are applied.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting design specifications and following instructions (oral or written)
- interpreting drawings
- weighing and measuring
- selecting appropriate tools and equipment
- selecting appropriate materials and manufacturing techniques
- applying appropriate fabrication and finishing procedures, which may include electroplating
- identifying alternative metals/materials
- meeting compliance specifications
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- entering routine and familiar information onto proformas and standard workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- reasons for selecting particular metals, construction methods, manufacturing and finishing techniques

## REQUIRED SKILLS AND KNOWLEDGE

- tools and equipment matched to processes
- planning/process stages
- working properties of precious and non-precious metals
- fine detail manufacturing processes
- knowledge of workplace hazards and emergency procedures
- various components of jewellery items
- appropriate measuring devices and recording methods
- procedures for final treatment/safe handling and storage of items
- occupational health and safety procedures
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to produce three-dimensional jewellery items. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with jewellery manufacture or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Items</b>	<p>Items involving a range of fabrication processes and techniques, for example various rings, broaches, bracelets, neckpieces</p>
<b>Material/s</b>	<ul style="list-style-type: none"> <li>• Precious and non-precious metals</li> <li>• Consumables including solders and fluxes, drills and blades, polishing compounds, cleaning and finishing materials, adhesives</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Tools, equipment</b>	All hand and power tools appropriate to construction and repair of jewellery items and personal protective equipment
<b>Appropriate preparation and fabrication techniques</b>	<ul style="list-style-type: none"> <li>Cutting, folding, bending, curving, dapping, drawing, rolling, doming, annealing, melting, granulation</li> <li>Primarily by brazing/silver soldering but may include other methods such as riveting</li> </ul>
<b>Documentation</b>	Job packet, work instructions and procedures, parts and components reference material, materials and consumables used, time and record sheets, drawings/illustrations, customer verbal/written specifications
<b>Final finish</b>	Filing, emery finishing, high and satin polish, various embellishment finishes (sandblasting, brushed, burring, reticulation, burnishing etc.)

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Jewellery and horological
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## MEM19006B Replace watch batteries

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting and replacing digital/analogue watch power cells.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the selection and replacement of digital/analogue watch power cells whilst operating in a jewellery/watch workshop environment with access to the appropriate equipment.</p> <p>Some knowledge of watch glasses and seals is required, however specific replacement functions for these are not covered by this unit. Testing functions relate only to the measurement of voltage, consumption and resistance.</p> <p>This competency does not apply to diver and other water-resistant watch types. Water resistance and pressure testing is not covered by this unit, however identification of watches requiring testing as well as procedures for arranging testing are a requirement of this unit.</p> <p>Where power cell replacements in these two categories are of common practice with associated testing, and/or identification/cleaning/supply/fitting of waterproofing/water resistance components, the appropriate horological units should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify watch case construction	1.1.Case material and construction is identified. 1.2.Case types and their functions are identified. 1.3.Associated parts and consumables are identified.
2. Open and close watches	2.1.Workshop tools and equipment are selected and used appropriately. 2.2.Watch cases are opened and closed correctly. 2.3.Parts are inspected and results are reported and/or



ELEMENT	PERFORMANCE CRITERIA
	recorded.
3. Select power cells	3.1.Appropriate batteries/power cells are selected.
4. Replace power cells	4.1.General inspection of surface/contact areas is performed. 4.2.Appropriate batteries/power cells are selected and installed. 4.3.Voltage, consumption and resistance are measured. 4.4.Power cells are handled and stored correctly.
5. Arrange water resistance and pressure testing	5.1.Watches requiring water resistance and/or pressure testing are identified. 5.2.Water resistance and pressure testing is arranged.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- handling case, movement and other watch parts
- cleaning case and watch parts
- opening/closing watch cases
- inspecting for obvious damage/wear and/or moisture intrusion.
- inserting and removing batteries
- interpreting charts and information sheets
- measuring voltage/ resistance/consumption
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings

#### Required knowledge

Look for evidence that confirms knowledge of:

- applicable horological terminology
- design of case types and their functions
- types of batteries/power cells and their functions
- battery cell construction

## REQUIRED SKILLS AND KNOWLEDGE

- cases including water resistant, dustproof and diver's
- analog, digital, multi-function and mechanical watch functions
- wear and the possible effects on glass and adjusters
- the watch-specific tools and equipment
- manufacturers' information/specifications/procedures
- location and cause of moisture and corrosion effects
- handling/cleaning/adjustment procedures
- OH&S issues for mercury and lithium batteries
- appropriate symbols and other identifying relevant standards information and their location
- relevant internal and/or external water resistance and pressure testing bodies/personnel
- arrangements/procedures for dispatch and receipt of watches
- battery features and identification codes
- parts associated with power cell function
- location and cause of moisture and corrosion effects
- watch functions
- procedures to confirm power cell status

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to replace digital/analog watch power cells. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where

**EVIDENCE GUIDE**

	<p>assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with battery replacement or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tools and equipment**

All hand and power tools appropriate to construction and repair of jewellery items and

**RANGE STATEMENT**

	personal protective equipment
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Jewellery and horological
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## MEM19007B Perform gemstone setting

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing most diamond and gem setting styles by manual methods.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to most diamond and gem setting styles by manual methods, with the aid of basic electrical/mechanical equipment.</p> <p>Techniques cover the basic forms of claw, grain and rub-over styles by manual methods, over a range of design styles.</p> <p>Metals may include precious jewellery metals and their alloys.</p> <p>The unit is not intended to cover the work of a specialist gemstone setter and typically applies in a jewellery manufacturing and repair environment.</p> <p>Do not select this unit for the setting of stones into wax, rubber, resin, etc. For production setting, Unit MEM07024B (Operate and monitor machine/process) should be considered.</p> <p>Where annealing and tempering are required, Unit MEM19005B (Produce three-dimensional precision items) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM19003B	Handle gem materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify setting requirements	1.1.Setting requirements are identified. 1.2.Gemstone status is assessed.

ELEMENT	PERFORMANCE CRITERIA
	1.3.Setting metal is identified.
2. Prepare materials and equipment for setting	2.1.Tools are selected for use in achieving the desired outcome. 2.2.Tools are prepared and maintained to produce required specifications. 2.3.Metal is prepared for setting.
3. Perform gemstone setting	3.1.Gemstones are secured correctly. 3.2.Setting metal is finished/burnished to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and preparing tools
- identifying metals
- identifying gemstone features
- adjusting, sharpening and maintaining tools
- preparing metals
- securing gemstones
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings

#### Required knowledge

Look for evidence that confirms knowledge of:

- setting processes and terminology
- gemstone features and handling procedures
- suitability of metal for carving and setting
- maintenance of tools
- setting techniques, processes and procedures
- working properties of materials

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform basic gemstone setting. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gemstone setting or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

#### Guidance information for



**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tools**

Various holding and securing devices, pliers, burrs, scaupers, burnishers, emery, beadars

**Setting requirements**

Type of setting, specific product handling measures

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Jewellery and horological
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## MEM19008B Prepare jewellery designs

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing jewellery designs and associated documentation with a view to producing the designed item/s.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to jewellery designs developed with view to producing the designed item/s using current commercial procedures, including traditional hand-fabrication techniques and/or in combination with a range of manufacturing technologies.</p> <p>Procedures may include CNC and mass finishing activities. Preparation of designs may include 2D and 3D CAD applications.</p> <p>Where CAD is used, the appropriate units should also be selected. Where jewellery illustrations only are prepared, Unit MEM19002B (Prepare jewellery illustrations) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM13004B	Work safely with molten metals/glass
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM19002B	Prepare jewellery illustrations
<b>Path 2</b>	MEM08010B	Manually finish/polish materials
	MEM13004B	Work safely with molten metals/glass
	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM19001B	Prepare jewellery metal casting
	MEM19002B	Prepare jewellery illustrations
<b>Path 3</b>	MEM16006A	Organise and communicate information
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work

Prerequisite units		
	MEM19003B	Handle gem materials
	MEM19007B	Perform gemstone setting
	MEM19014B	Perform hand engraving

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify design requirements	1.1.Design requirements, purpose and needs are determined from a variety of applicable sources and reference documents. 1.2.Where necessary, further research/idea development is undertaken. 1.3.Information is consolidated and analysed. 1.4.Where applicable, customer is advised on design considerations and limitations and further clarification is gained as necessary.
2. Develop design concept	2.1.Concept is developed, employing design principles. 2.2.Design process is documented.

ELEMENT	PERFORMANCE CRITERIA
	2.3. Basic forms and proportions are established. 2.4. Where applicable, decorative aesthetics are applied. 2.5. Design concept is confirmed as necessary.
3. Produce drawings for item manufacture	3.1. Appropriate manufacturing technologies are selected. 3.2. Working technical and finished drawings are developed. 3.3. Production requirements/instructions are specified and communicated to appropriate persons.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting information on specifications, design documentation, illustrations, design drawings and other applicable source documents
- identifying purpose and needs, including design restraints, budget considerations, item end-use, proportions and desired features, available materials
- checking and clarifying information
- developing research/idea to sufficient level in order to determine customer expectations and/or design outcomes
- evaluating abstract and applied concepts/data for use in a commercial environment
- interpreting design concepts/drafts as appropriate for client/industry technician
- collecting and collating data relevant to design
- communicating concepts in terms suitable to relevant customer or other contacts e.g. engineer, master pattern maker
- documenting and maintaining design process, features and design development notes
- producing basic form drawings that accurately reflect design concept
- using balance, proportion, highlights, shadowing, texturing effects appropriately
- selecting technologies suitable for manufacture of item(s)
- undertake numerical operations, geometry and calculations within the scope of the unit

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- design resources and where to locate them
- research techniques and available resources
- social trends, cultural/environmental/social context
- relevant industry literature
- existing designs, ethical and competitive considerations
- applicable industry standards or regulations
- brainstorming techniques for research/idea development
- design principles including form, function, harmony, line definition (interpretive/actual)
- drawing media and their functions/applications including paper, watercolour, pastel/ink/pencil
- drawing tools and their functions/applications including stencils, rubbers etc.
- design documentation
- form drawing development
- geometric forms and drawing techniques e.g. cones, cylinders, cube, rectangle, sphere etc. 3D concept, axis lines, conversion of 2D to 3D concepts, depth, perspective and scale (1,2,3 point)
- enhancement techniques
- available manufacturing technologies and their suitability for jewellery manufacture
- types of working drawings and their uses
- the inter-relation between technical and design drawings
- industry requirements and availability of industry expertise
- hazard and control measures associated with preparing jewellery designs
- safe work practices

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare jewellery designs. Competency in this unit cannot be claimed until all prerequisites have been

<b>EVIDENCE GUIDE</b>	
	satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing jewellery designs or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Design requirements</b>	<ul style="list-style-type: none"> <li>• Materials</li> <li>• Stone specifications</li> <li>• Special requirements</li> <li>• Size restrictions</li> <li>• Budgetary range</li> </ul>
<b>Design principles</b>	<ul style="list-style-type: none"> <li>• Correct construction techniques employed</li> <li>• Construction limitations of materials</li> <li>• Drawing to scale for designs</li> <li>• Form, function, harmony, line definition (interpretive/actual)</li> </ul>
<b>Decorative aesthetics</b>	Surface finishing such as sandblasting, polishing, electroplating

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Jewellery and horological
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## MEM19009B Perform investment procedures for lost wax casting process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing investment flasks for jewellery casting.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the preparation of investment flasks using manual and/or automatic equipment for jewellery casting procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools

<b>Prerequisite units</b>		
<b>Path 2</b>	MEM07024B	Operate and monitor machine/process
	MEM12024A	Perform computations
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare investment materials	1.1.Sprue/tree materials are prepared/built, if necessary. 1.2.Assembled tree/materials are checked, if necessary. 1.3.Casting methods and equipment are selected appropriate to task. 1.4.Associated tools and equipment are prepared.
2. Invest flask	2.1.Flask is assembled for casting. 2.2.Investment is mixed correctly. 2.3.Curing stage is prepared.

ELEMENT	PERFORMANCE CRITERIA
3. Operate 'lost wax' sequence	3.1. 'Low melt' wax is evacuated by steam process, if necessary. 3.2. Investment flask is positioned/stored correctly. 3.3. 'Burn-out' procedure is selected and applied.
4. Decontaminate/clean site	4.1. Tools, equipment and site area are cleaned correctly.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and following routine task-related information
- checking pre-assembled wax for security, size, and weight
- selecting/checking/cleaning sprue and investment materials
- selecting appropriate components
- recording weights
- selecting and assembling appropriate flask size
- calculating and weighing out proportions of investment material and water
- performing mixing, vibrating and vacuum procedures
- operating steamer and process
- inspecting flasks for residue prior to burn-out
- selecting appropriate burn-out procedure/equipment
- positioning/storing flask
- inspecting and adjusting oven/kiln cavity
- cleaning working area, and all tools and investing equipment of investment residue
- disposing of residue and materials

#### Required knowledge

Look for evidence that confirms knowledge of:

- procedures for checking built wax
- casting methods and equipment and processes
- sprue/investment/tools/equipment/materials
- techniques for sprue/tree styles and selection/application of the processes

## REQUIRED SKILLS AND KNOWLEDGE

- selection of flask and components for specific casting processes
- procedures and computations for mixing proportions, time calculations, volume and weights, etc.
- appropriate gloss off/set time allowance prior to base removal
- occupational health and safety requirements/issues
- requirements for curing/set stage
- sequence and values for time, temperature, and/or cam settings
- steamer process
- suitability of flask/investment for burn-out
- sequence, procedures, adjustments for variables
- procedures for storage and positioning
- procedures for cleaning, storage and/or removal of materials
- the reasons for appropriate/approved housekeeping functions
- recording procedures
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform investment procedures for 'lost wax' casting process. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not

**EVIDENCE GUIDE**

	<p>in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing investment procedures for 'lost wax' casting process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Casting method and equipment</b>	Centrifical and vacuum casting
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**RANGE STATEMENT****Associated tools and equipment**

- Flasks and base
- Investment
- Scales
- Mixers
- Bowls
- Vacuum

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Jewellery and horological



## MEM19010B Produce rubber moulds for lost wax casting process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing flexible moulds for the purpose of replicating an original model.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the preparation of flexible moulds to replicate an original model. Types of rubber material used may include natural and silicon varieties of differing working specifications such as shrinkage and transparency. Vulcanisation may include RTV as well as standard heat and pressure combinations.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare and pack mould frame/systems	1.1.Appropriate mould frame/moulding system is selected for given job. 1.2.Appropriate rubber is selected for style of master. 1.3.Rubber is prepared and packed correctly.
2. Vulcanise/cure rubber	2.1.Appropriate curing system is selected. 2.2.Assembled mould is cured, cooled, removed.
3. Release mould	3.1.Appropriate tools and procedure for the release of master pattern are selected. 3.2.Master pattern is released correctly.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in:

**REQUIRED SKILLS AND KNOWLEDGE**

- following work procedures
- selecting appropriate frame/system to suit master requirements
- preparing/packing master, frame/system
- selecting variables of time, temperature, and pressure
- cutting rubber
- selecting and using tools/methods for release of master
- safely releasing master without damage
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- using measurement skills needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms
- planning, sequencing operations

**Required knowledge**

Look for evidence that confirms knowledge of:

- work procedures
- procedures for assessing frame/system
- the specific master requirements
- procedures for assessing rubber/ master suitability/compatibility
- working limitations of rubber
- procedures for correct packing technique
- packing variations for a range of situations
- methods for establishing the appropriate time, temperature and pressure settings for the selected process
- the stages in the process for mould curing, removal and cooling
- correct selection of tools/procedures
- sequence of procedures for release of master
- the placement of mould/vent lines
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce rubber moulds for 'lost wax' process.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing rubber moulds for 'lost wax' process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Mould frame/moulding system</b>	Various shapes and sizes, solid or component systems
<b>Rubber</b>	Silicon, natural rubber
<b>Curing system</b>	Vulcaniser
<b>Tools</b>	Scalpel, vice

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Jewellery and horological
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## MEM19011B Perform wax injection of moulds for lost wax casting process

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers injecting materials under pressure for investment and burn-out aspects within 'lost wax' casting procedures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies primarily to organic/synthetic wax injection, but may include resin and plastic materials injected under pressure for investment and burn-out aspects within 'lost wax' casting procedures.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform wax injection of moulds	1.1.Appropriate wax material is selected for given task. 1.2.Injection equipment/tools are prepared. 1.3.Moulds are prepared correctly. 1.4.Wax injection procedures are carried out correctly.
2. Remove and inspect patterns	2.1.Wax pattern is removed without damage. 2.2.Wax pattern is inspected and stored as required. 2.3.Work area is secured and cleaned.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>
Look for evidence that confirms skills in: <ul style="list-style-type: none"><li>• following work procedures</li><li>• selecting wax type according to wax/model/cavity specifications</li></ul>



**REQUIRED SKILLS AND KNOWLEDGE**

- preparing moulds
- rectifying inappropriate mould features
- completing injection
- removing duplicated wax pattern
- checking duplicate for compliance with master/specifications and irregularities
- reporting/recording irregularities
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- using measurement skills needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms
- planning, sequencing operations

**Required knowledge**

Look for evidence that confirms knowledge of:

- wax types and characteristics
- procedures for wax injection equipment/processes for the given values of time, temperature, pressure
- mould conditions
- injection procedures
- minor variations and adjustments to processes/ equipment situations
- undamaged wax duplicate removal techniques for a range of situations
- procedures for wax duplicate inspection
- common irregularities
- causes of imperfections
- remedies for imperfections
- safe storage procedures
- procedures for safe cleaning, disposal, and storage
- hazards and control measures associated with working with hot wax, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the

<b>EVIDENCE GUIDE</b>	
performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform wax injection of moulds for 'lost wax' casting process.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing wax injection of moulds for 'lost wax' casting process or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Wax material**

Type of wax according to design specification requirements

**Inspected**

For missing elements, alignment of rubber mould, air bubbles, shrinkage or distortion

## Unit Sector(s)

**Unit sector**

## Co-requisite units

**Co-requisite units**

## Competency field

**Competency field**

Jewellery and horological

## MEM19012B Produce jewellery wax model

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing one-off wax models in simple to moderate carved forms and simple to moderate structural forms.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the production of wax models for a range of jewellery products, simple to moderate carved forms, simple to moderate structural forms. Processes may include free-form carving moderate detail with some fine detail. This unit is not intended to include fine wire filigree work. Appropriate awareness of occupational health and safety issues and measures, including the use of protective equipment is applied, including control of melting wax, knowledge of effects of toxic fumes.</p> <p>For modelling with the use of computer aided equipment, Units MEM09009C (Create 2D drawings using computer aided design system) and Units MEM09010C (Create 3D models using computer aided design system) should be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine master requirements	1.1.Customer specifications are identified.
2. Prepare materials for production of wax model	2.1.Appropriate waxes are selected. 2.2.Stock materials are cut to appropriate length. 2.3.Appropriate tools are selected and used.
3. Produce wax models	3.1.Material use and production time are optimised. 3.2.Wax is sculpted to specifications.
4. Finish wax models	4.1.Imperfections in final wax model are minimised.

ELEMENT	PERFORMANCE CRITERIA
	4.2.Surface finishes are applied.
5. Assess suitability of final wax product	5.1.Product is inspected for compliance with specifications. 5.2.Final product is modified as necessary.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- clarifying customer specifications
- selecting appropriate method for construction of wax model for the supplied specifications
- selecting wax to suit construction method and required finish
- roughing out shapes with minimal wastage, effort/time in final finishing
- fusing joints to achieve optimum strength and quality
- applying texture finishing, high polishes, etc.
- using protective safety equipment
- inspecting product for correct tolerances, allowance for casting shrinkage and finishing processes
- modifying original product to meet required tolerances and finishes
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- using measurement skills needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms
- planning, sequencing operations

#### Required knowledge

Look for evidence that confirms knowledge of:

- factors affecting construction of wax model, including type of wax, hand tools, method of construction, final finish, weight of finished product
- variations in end product and the relationship with wax types
- methods to be used to produce the outcome requirements/specifications and minimise waste

## REQUIRED SKILLS AND KNOWLEDGE

- tools for preparing and producing wax for specific wax types and constructions
- importance of minimising material wastage and time taken during roughing/finishing
- appropriate key features/datum points
- purpose/requirements for selected surface finish
- evaluation of product by weight formulation
- effects of toxic fumes of melting wax
- effects of casting shrinkage and finishing processes
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to produce a jewellery wax model. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing a jewellery wax model or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Materials</b>	Materials may include those of different colours/hardness/properties
<b>Tools</b>	Electric and hand held tools, e.g. heat irons, wax guns, saws, carving tools, wax files, flaming torch
<b>Surface finishes</b>	Fine emery, Shellite



**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Jewellery and horological
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## MEM19013B Produce jewellery metal masters

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the manufacturing jewellery master pattern(s) for jewellery reproduction, mainly by hand held application of processes. It requires the application of precision measurement and hand-making/machine skills to a greater level than that required in Unit MEM19005B (Produce three-dimensional precision items).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the manufacture of jewellery master pattern(s) for jewellery reproduction, mainly by the hand held application of processes. Work would be mainly autonomous in a jewellery manufacturing environment.</p> <p>Understanding the principles of casting/moulding/shrinkage and wax injection is required. General production processes used to finish the reproductions must be understood. Competency in this unit cannot be fully met without appropriate comparison to the finished production item.</p> <p>Where machining is required as a major component of this manufacturing concept, then unit MEM07005C (Perform general machining) should be selected. The equipment used may include hand and power tools, lathes and non-CNC machines.</p> <p>Where component(s) require preparation or manufacture by NC/CNC/CAD/CAM as an integral part of this process by the person working autonomously, the relevant competencies should be accessed.</p> <p>If electro-deposition and/or electro-forming of metal is required, MEM07024B (Operate and monitor machine/process) or Unit MEM08003C (Perform electroplating operations) should also be selected.</p>
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	<p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM08010B	Manually finish/polish materials
	MEM13004B	Work safely with molten metals/glass
	MEM16006A	Organise and communicate information
	MEM19001B	Perform jewellery metal casting

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine master pattern requirements	1.1.Specifications and drawings are interpreted for required pattern information. 1.2.Technique/process to achieve suitable quality finish for masters are selected. 1.3.Materials to produce given item are selected. 1.4.Tools, equipment and processes appropriate to task are selected.
2. Produce master	2.1.Materials are marked out and/or construction plan developed to meet specifications/stages of process. 2.2.Pattern material(s) are prepared. 2.3.Master is produced.
3. Finish and inspect work	3.1.Item is checked for compliance with specifications. 3.2.Weights and measurements are recorded. 3.3.Sprue material is fitted if necessary. 3.4.Final finish is applied, where appropriate, and item is stored. 3.5.Master is evaluated and compared to production sample.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- following procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- planning and sequencing operations
- checking and clarifying task-related information
- entering information onto proformas and other workplace forms
- checking for conformance to specifications
- using precision measurement equipment
- measuring items to specified tolerances
- undertaking numerical operations and calculations/formulae within the scope of this unit
- following verbal instructions
- orally reporting information
- collecting and assessing data for practical applications
- selecting methods, materials and tools/equipment
- selecting and using tools/equipment/processes
- applying a working knowledge of metals and materials
- pre-forming/producing item/components to size and shape
- checking product for compliance to specifications and design outcomes
- matching product to original design concept/drawings/ specifications
- inspecting surface condition for pre-treatment/plating process
- making allowance for sequential processes
- recording statistical evidence
- positioning/securing sprue section
- undertake final treatments according to standard operating procedures and OH&S
- handling and storing products
- comparing/calculating design specifications

**Required knowledge**

Look for evidence that confirms knowledge of:

- understanding of the principles of casting, moulding, shrinkage, and wax injection
- location of information/specifications
- clarification approval processes
- collective information/drawings/specification/product development plans
- wrought, forge, machine and cast techniques and applications
- the appropriate properties/function of materials
- prerequisite working specifications/abilities/limitations of selected materials
- stored data on specifications and processes
- planning/process stages
- the difference between master and finished item specifications
- fine detail work processes
- levels of acceptable performance and productivity outcomes
- finishing processes

## REQUIRED SKILLS AND KNOWLEDGE

- sequential processes required for design outcomes
- inspection and compliance checks
- surface/parts/areas appropriate for post production processes for setting/electroplating/enamelling, and for the subsequent processes of moulding and waxing
- reasons for the recording of specifications
- appropriate measuring devices and recording methods
- handling and design needs associated with sprue placement
- appropriate knowledge of wax injection, moulding, casting, molten metal flow/solidification
- procedures for final treatment/safe handling/storage of item
- relevancy of calculations/specifications
- appropriate techniques, tools and equipment to measure machined components
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures
- reasons tools, equipment, resources and reference material are stored in accordance with OH&S and standard operating procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to produce jewellery metal masters. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not

**EVIDENCE GUIDE**

	<p>in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing jewellery metal masters or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Technique/process</b>	High polish
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**RANGE STATEMENT**

<b>Materials</b>	Jewellery alloys and/or their base metals
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Jewellery and horological
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## MEM19014B Perform hand engraving

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic hand engraving
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to basic hand tool applications; with scorpers/gravers as the predominant hand tools, and does not include the use of any power/air driven apparatus.</p> <p>Work includes basic block/script lettering and carving techniques on mostly flat surfaces to achieve patterns in relief or intaglio.</p> <p>It applies to manufacturing jewellers or to establishments providing general engraving services.</p> <p>Where the work being performed requires the item to have shaping/drilling/contour modification using power tools, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Use of power/air driven apparatus to perform engraving is covered by Unit MEM18002B (Use power tools/hand held operations).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify engraving requirements	1.1.Engraving requirements are identified from applicable documents. 1.2.Sequence of procedures is correctly identified.
2. Select and maintain engraving equipment and accessories	2.1.Appropriate equipment is selected for use. 2.2.Gravers are prepared to industry standards.
3. Perform hand engraving	3.1.Item is measured and marked out for engraving as required. 3.2.Work piece is positioned and held/clamped effectively and without damage to the work piece. 3.3.Work is undertaken according to standard work

ELEMENT	PERFORMANCE CRITERIA
	procedures and workplace/industry standards.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- identifying the engraving sequence
- selecting and using gravers, scorpers and other applicable tools
- controlling engraving tools
- machining and sharpening graver shape and cutting angles
- using datum lines/points
- handling and securing work pieces
- maintaining points/cutting edges/polished faces

#### Required knowledge

Look for evidence that confirms knowledge of:

- engraving terminology
- sources of task-related information
- securing methods and limitations
- different gravers, scorpers and other tools and their applications
- techniques for producing and maintaining cutting edges
- equipment used for maintaining gravers
- required industry standards
- tool maintenance
- basic hand engraving techniques
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform hand engraving. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing hand engraving or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

<b>EVIDENCE GUIDE</b>	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Engraving requirements</b>	Lettering / pictures, size, style
<b>Equipment</b>	Scorpers, gravers

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Jewellery and horological
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## MEM19015B Perform jewellery enamelling

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing most jewellery-scale and some larger-scale enamelling techniques applied to precious metals and some base metals, using torch and kiln methods.
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### Application of the Unit

<b>Application of the unit</b>	Work is undertaken autonomously or within a team environment using predetermined standards of quality, safety, workplace procedures and accepted workplace techniques/methods. It does not apply to complex three-dimensional forms and plique-a-jour techniques.  <b>Band: A</b> <b>Unit Weight: 4</b>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	MEM18001C

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify enamelling requirements	1.1. Enamelling requirements are identified from workplace documentation and customer requirements. 1.2. Item materials and construction are assessed for enamelling suitability. 1.3. Appropriate enamelling technique and materials are selected for the required outcome.
2. Prepare items and materials for enamelling	2.1. Enamels are prepared for enamelling operation. 2.2. Metal surfaces are prepared for enamelling. 2.3. Additional processing of item is carried out prior to enamelling.
3. Enamel jewellery items	3.1. Equipment and items are set up for firing. 3.2. Items are enamelled to specification. 3.3. Items are fired correctly.
4. Finish and inspect work	4.1. Final finishes are applied. 4.2. Product is checked for compliance to specifications. 4.3. Faults are rectified. 4.4. Relevant job information is recorded.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting instructions and job requirements from job packets, verbal or written instructions/diagrams
- checking and clarifying task-related information
- analysing item features/properties/construction for enamelling suitability
- selecting colour appropriate to job specification/design
- selecting enamelling technique/materials to suit job specification/design, item properties and construction
- washing and/or grinding enamels
- cleaning, polishing/burnishing and pre-treating and pickling metals by hand
- performing additional processing requirements
- applying enamel to achieve desired outcome
- setting equipment to correct temperature
- positioning items for firing using appropriate work holding devices
- monitoring and gauging stages
- removing from heat source at appropriate time to avoid over/under firing
- applying different firing techniques and final treatments/finishes
- masking out
- final firing polishing
- checking for conformance to specifications/ design requirements
- identifying causes of non-conformances
- rectifying faults
- entering information onto proformas and other workplace forms

#### Required knowledge

Look for evidence that confirms knowledge of:

- enamels, base metals and properties relating to enamelling, enamelling techniques, firing techniques and work holding devices, faults and common rectification methods
- factors for determining suitability for enamelling including available enamelling compositions, firing temperatures, metal type and properties, item construction
- different enamelling techniques and terms

**REQUIRED SKILLS AND KNOWLEDGE**

- enamelling compositions and techniques and related to specific item properties and factors such as metal type/properties, item construction, firing temperature
- enamels and forms of availability for purchase including leaded/unleaded, opaque/transparent
- terms applied to various enamelling techniques
- use of enamel colour chart to determine suitable colours
- correct working procedures during the preparation of enamel powder
- techniques for washing and grinding enamels, when required, and reasons for doing so
- preparation of metal surfaces by hand cleaning, polishing/burnishing, chemical pre-treatment by acid, surface depletion methods and application to different metals
- hazards and safety measures relating to pre-treatment of metals and preparation of enamels/metals
- additional processing, including stamping, engraving, saw piercing, chasing, oxidising, roller pressing
- tools and equipment for processing and their uses
- methods of applying enamels including wet packing, dry dusting
- melting temperatures of metals and enamels
- work-holding devices
- visual appearance of enamel at different stages of firing process
- counter-enamelling techniques and reasons for doing so
- cleaning and lapping processes between firing
- different finishes and methods for achieving specific effects
- masking out methods
- final firing and polishing methods
- features and factors for compliance from original specifications and/or job requirements
- common enamelling faults/incorrect outcomes and their causes, including oxidation, staining, under/over firing
- actions to rectify faults using standard techniques/methods
- job data to be recorded
- procedures to record data
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform jewellery enamelling on a range of materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing jewellery enamelling or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Enamelling technique**

Torch and kiln firing and would include dusting, cloisonne, basse-taille and champleve

**Item**

Rings, brooches, earrings, pendants and other small-scale objects

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Jewellery and horological
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## MEM19016B Construct jewellery components

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers constructing jewellery components or single-piece items of basic design.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies use of common jewellery tools/equipment and safe and efficient work practices to transfer designs to templates and work pieces, produce two-dimensional patterns/blanks and form and finish components/items.</p> <p>Metals and consumables include precious and non-precious metals, solders and fluxes, drills and blades, polishing compounds, cleaning and finishing materials, adhesives.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering

<b>Prerequisite units</b>		
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify pattern and component/item requirements	1.1.Component/item specifications are identified from work instruction. 1.2.Design requirements are identified from work instruction. 1.3.Forming, joining and finishing requirements are identified from work instruction.
2. Transfer designs to templates and work pieces	2.1.Work pieces are prepared as required for drawing transfer. 2.2.Accurate representations component specifications are transferred onto templates or work pieces. 2.3.Material wastage is minimised.
3. Produce 2D patterns/blanks	3.1.Patterns/blanks are produced to specification.

ELEMENT	PERFORMANCE CRITERIA
4. Form and finish components/items	4.1.The formed item conforms to design requirements. 4.2.Appropriate tools and equipment are selected for forming, joining and finishing. 4.3.Components/formed items are joined as required. 4.4.Components/items are finished to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying component type, design, material type and specifications from verbal/written instructions, jewellery illustrations and samples
- identifying transfer method from work instruction
- selecting transfer materials, tools and equipment
- identifying required techniques/methods and steps
- selecting and using tools and equipment for forming, joining and finishing
- cutting, rolling and shaping to correct size/thickness
- transcribing markings clearly and accurately onto work piece or template
- adhering templates to work pieces
- transferring design to optimise use of material
- minimising filing and finishing requirements
- following design markings
- filing, emery finishing pattern/blank
- folding, bending, curving, dapping etc. as required
- achieving correct symmetry, angle, shape
- correctly aligning joins
- removing excess materials by filing, emery etc.
- undertaking re-forming adjustments if necessary to achieve specifications
- removing scratches, scribe marks and other markings by file, emery etc. to a fine emery finish
- polishing item according to standard operating procedure

#### Required knowledge



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- metal types, applications and properties
- jewellery items and components
- methods and tools for transferring designs
- selection of blades, drills and files
- techniques and methods for forming and finishing components/single piece
- tools and equipment for forming and finishing
- polishing techniques
- safe operation of equipment
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to construct jewellery components or single-piece items of basic design. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

<b>EVIDENCE GUIDE</b>	
	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with constructing jewellery components or items or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Components/items</b>	Components or single-piece items of basic design
<b>Design requirements</b>	Instructions from supervisor/management, job packet
<b>Forming methods</b>	Cutting, folding, bending, curving, dapping
<b>Joining methods</b>	Primarily by brazing/silver soldering but may include other methods such as riveting

<b>RANGE STATEMENT</b>	
<b>Finishing processes</b>	Filing, emery finishing, basic polishing
<b>Transfer design</b>	Transfer direct to work piece using permanent pen, scribe, freehand and/or by compass, dividers, chinagraph pencil, carbon paper tracing or drawn/copied to template and adhered to work piece
<b>Tools and equipment</b>	Compass, dividers, rules, squares, spring gauges, vernier calipers, piercing saw, files, drill press/pedestal drill, polishing equipment and compounds, ultrasonic cleaner

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Jewellery and horological
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## MEM19017B Fabricate jewellery items

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers constructing jewellery components, single and multiple-piece items involving a range of fabrication processes and techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the construction of jewellery components, single-piece and multiple-piece items involving a range of fabrication processes and techniques.</p> <p>It requires the ability to use jewellery tools and equipment and safe and efficient work practices to identify fabrication requirements, prepare materials/manufacture components for fabrication and fabricate and finish items.</p> <p>If electroplating skills are required, Unit MEM08003C (Perform electroplating operations) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify fabrication requirements	<p>1.1.Item design characteristics, dimensions, construction, composition and finish are established from predetermined specifications in accordance with organisational and client requirements.</p> <p>1.2.Fabrication and finish specifications and required outcomes are confirmed and clarified as necessary with appropriate person(s) and in accordance with organisational requirements.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.3.Appropriate preparation and fabrication techniques are established in accordance with item construction, verbal and written specifications, organisational requirements and personal abilities.</p> <p>1.4.Fabrication and finishing activities are prioritised in accordance with designated timeframes, organisational and specific fabrication requirements.</p>
2. Prepare materials for fabrication	<p>2.1.Components, materials and consumables are selected/obtained in accordance with organisational requirements and in consultation with appropriate person(s).</p> <p>2.2.Metals are alloyed to specified quality, as required.</p> <p>2.3.Metals are rolled/drawn down/cut to required dimensions.</p> <p>2.4.Tools and equipment are selected and used appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications and organisational procedures.</p> <p>2.5.Material preparation is conducted using safe operating practices and protective equipment, in accordance with OHS and organisational requirements.</p>
3. Fabricate jewellery item	<p>3.1.Tools and equipment for fabrication are selected and used appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications and organisational procedures.</p> <p>3.2.Applicable fabrication activities are performed using safe operating practices and protective equipment, and in accordance with OHS, organisational and industry accepted methods.</p> <p>3.3.Item is checked to ensure construction conforms with required specifications, quality, organisational and applicable industry standards.</p>
4. Finish jewellery items	<p>4.1.The appropriate surface finish is produced to required specifications in accordance with organisational requirements.</p> <p>4.2.Tools and equipment for embellishing and polishing are selected and used appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications and organisational procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
5. Complete fabrication	<p>5.1.Finished item is packaged/presented and stored safely in accordance with organisational requirements.</p> <p>5.2.Documentation is accurately completed and processed in accordance with organisational requirements and standards.</p> <p>5.3.Notification of work completion is made to appropriate person(s) in accordance with organisational procedures.</p> <p>5.4.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>5.5.Unused/excess materials are collected and stored/reclaimed in accordance with organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting design specifications and follow instructions (oral or written)
- interpreting drawings
- weighing and measuring
- selecting appropriate tools and equipment
- selecting appropriate materials and manufacturing techniques
- applying appropriate fabrication and finishing procedures
- applying safe working skills
- identifying alternative metals

#### Required knowledge

Look for evidence that confirms knowledge of:

- metals and materials for fabricating a range of jewellery items/designs
- common jewellery design features, constructions and finishes
- metal preparation and fabrication techniques to suit different design requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- factors affecting the selection of preparation and fabrication methods
- organisational requirements for fabrication activities
- relevant materials and consumables for given jewellery fabrication jobs
- properties and characteristics of applicable metals
- ratios to create required grade/quality/composition of metals
- melting temperatures and preparation methods for melting applicable metals
- types of ingot moulds and their characteristics/applications
- methods, applications, equipment types and operational requirements for rolling and drawing metals
- process for annealing metals to prevent work hardening
- procedures for checking serviceability of applicable tools and equipment
- safe operating procedure for applicable tools and equipment
- applicable fabrication techniques and processes
- organisation of customer service, quality and work standards
- accepted industry standards of quality
- tools, techniques and materials for embellishing and polishing
- organisation procedures for storage and packaging/presentation of finished items
- security measures for protection of jewellery items
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to fabricate jewellery items. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a



**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the fabrication of fine jewellery or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Appropriate person(s)</b>	Supervisor, client, colleague
<b>Appropriate preparation and fabrication techniques</b>	<ul style="list-style-type: none"> <li>Cutting, folding, bending, curving, dapping, drawing, rolling, doming, annealing, melting, granulation</li> <li>Primarily by brazing/silver soldering but may include other methods such as riveting</li> </ul>
<b>Finishing activities</b>	Filing, emery finishing, high and satin polish, various embellishment finishes (sandblasting, brushed, burring, reticulation, burnishing etc.)
<b>Components</b>	Components, single-piece and multiple-piece items involving a range of fabrication processes and techniques, for example various clips, catches and pins
<b>Materials</b>	Precious and non-precious metals
<b>Consumables</b>	Solders and fluxes, drills and blades, polishing compounds, cleaning and finishing materials
<b>Tools and equipment</b>	All hand and power tools appropriate to fabrication of jewellery items and personal protective equipment
<b>Documentation</b>	Job packet, work instructions and procedures, parts and components reference material, materials and consumables used, time and record sheets

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Jewellery and horological
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## MEM19018B Repair jewellery items

### Modification History

Prerequisite unit MEM05006B updated to MEM05006C

Editorial correction to unit application to include missing notes relating to dual status.

Single band identifier removed to clarify dual status.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers making common repairs to a range of jewellery items. It requires the application of skills and knowledge in jewellery manufacturing and finishing techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to a range of repair work carried out in a jewellery manufacture/repair environment. It requires the ability to use safe and efficient work practices to identify the condition of the item, establish repair requirements and complete and finalise the repair work.</p> <p>If an estimate or quotation for repair is produced, then Unit PRSTS317A (Provide estimate and quote) should also be selected.</p> <p>If jewellery setting is required, then Unit MEM19007B (Perform gemstone setting) should also be selected.</p> <p>If replacement components need to be manufactured for the repair, then the appropriate units should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM05006C	Perform brazing and/or silver soldering
	MEM12023A	Perform engineering measurements
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM19001B	Perform jewellery metal casting
	MEM19003B	Handle gem materials
	MEM19016B	Construct jewellery components
	MEM19017B	Fabricate jewellery items

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the
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	required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess item condition	<p>1.1.Item characteristics, construction and composition are identified from specifications in accordance with organisational requirements.</p> <p>1.2.Personal limitations in assessing item condition are identified and assistance is sought from appropriate sources in accordance with organisational procedures.</p> <p>1.3.Condition of item and nature/extent of damage is verified in accordance with organisational procedures, established inspection techniques and original specifications.</p>
2. Establish repair requirements and materials	<p>2.1.Repair requirements, options and recommended actions are established in accordance with organisational requirements and factors impacting on feasibility of repair.</p> <p>2.2.Recommended repairs and options are conveyed to client and required repair is work confirmed in accordance with organisational requirements.</p> <p>2.3.Appropriate repair techniques are selected in accordance with item construction/condition and identified repair requirements.</p> <p>2.4.Replacement components are obtained and/or manufactured in accordance with organisational requirements and in consultation with appropriate person(s).</p>
3. Carry out repairs	<p>3.1.Unforeseen conditions/effects of the repair work are identified and appropriate actions are taken in accordance with organisational requirements.</p> <p>3.2.Tools, equipment, materials and consumables are selected and used appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications and organisational procedures.</p> <p>3.3.All work is conducted using safe operating practices and protective equipment in accordance with OHS</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>and organisational requirements.</p> <p>3.4.Evidence of the repair/repair area is minimised.</p> <p>3.5.Repaired item conforms with original specifications and/or identified customer requirements.</p>
4. Finalise repair	<p>4.1.Finished item is packaged/presented and stored safely in accordance with organisational requirements.</p> <p>4.2.Repair work is documented and confirmed with appropriate person(s) in accordance with organisational procedures.</p> <p>4.3.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>4.4.Unused/excess materials are collected and stored/reclaimed in accordance with organisational and requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting design requirements and following instructions (oral or written)
- interpreting drawings
- weighing and measuring
- selecting appropriate tools and equipment
- selecting appropriate materials and repair/manufacturing techniques
- applying appropriate fabrication and finishing procedures
- working safely
- identifying alternative metals
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- entering routine and familiar information onto proforma and standard workplace forms

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- reasons for selecting particular metals, construction methods, repair/manufacturing and finishing techniques
- knowledge of workplace hazards and emergency procedures
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to repair to jewellery items in accordance with customary industry practice. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with jewellery repair or other units requiring the exercise



<b>EVIDENCE GUIDE</b>	
	of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Factors impacting on feasibility of repair</b>	Cost, time, feasibility, value
<b>Repair techniques</b>	<ul style="list-style-type: none"> <li>• Retipping</li> <li>• Reshank</li> <li>• Restoration</li> <li>• New collets</li> <li>• Chain repairs</li> <li>• Fastening mechanism repairs</li> </ul>
<b>Appropriate person(s)</b>	Supervisors, managers, suppliers, technical experts, colleagues

<b>RANGE STATEMENT</b>	
<b>Unforeseen conditions/effects</b>	Effects which could be caused by previous construction and repair techniques Effects of the repair process on stones or other components
<b>Tools, equipment</b>	All hand and power tools appropriate to construction and repair of jewellery items and personal protective equipment
<b>Materials</b>	Precious and non-precious metals
<b>Consumables</b>	Solders and fluxes, drills and blades, polishing compounds, cleaning and finishing materials, adhesives
<b>Documentation</b>	Job packet, work instructions and procedures, parts and components reference material, materials and consumables used, time and record sheets

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Jewellery and horological
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## MEM19020B Fault-find and maintain micro-mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers fault-finding and maintaining micro-mechanisms.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to watch and/or clock servicing and repair work. Environments may include retail operations through to servicing departments of manufacturers.</p> <p>This unit does not extend to adjusting indexing system for acoustic resonator watches, chronometer escapements and chronograph mechanisms.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools

<b>Prerequisite units</b>		
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Dismantle micro-mechanism components	1.1.Micromechanism components are dismantled for inspection using techniques and principles appropriate to the task.
2. Verify condition and operation of components	2.1.Overall condition of micro-mechanism is assessed. 2.2.Physical condition and operational functioning of components inspected and verified, if necessary, with appropriate persons. 2.3.Faults are identified using tools, equipment and techniques appropriate to the task.
3. Carry out maintenance	3.1.Maintenance requirements are confirmed, if necessary, with appropriate persons.

ELEMENT	PERFORMANCE CRITERIA
	3.2.Components are lubricated to specification. 3.3.Components are cleaned/replaced and installed as required.
4. Assemble components	4.1.Components are assembled to specification.
5. Check and adjust components	5.1.Components are checked for correct operation. 5.2.Components are adjusted to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- dismantling/removing components using appropriate hand tools and techniques
- removing power from the spring
- removing and dismantling movement
- removing and dismantling balance assembly
- removing/dismantling bridges, mainspring, barrel, winding mechanism
- applying procedures to avoid damage to components during disassembly/assembly
- noting position/assembly of components for re-assembly
- checking timepiece for overall condition, damage to case etc.
- cleaning and preparing components for inspection, including movement
- checking components for evidence of toxic contamination, pollution, chemical waste and other contaminants
- checking operation/function of components using appropriate tools and techniques
- identifying defective, damaged or non-serviceable components
- following standard/routine procedures to locate/identify common faults and maintenance requirement
- applying lubricants using appropriate techniques
- cleaning/replacing components in correct sequence, using appropriate tools and techniques
- following OHS procedures
- handling components
- assembling components to specification, including, barrel and mainspring, mechanism (movement), canon pinion, drive train, balance assembly, shock resist

## REQUIRED SKILLS AND KNOWLEDGE

- system, calendar, winding system and other mechanisms
- verifying operation of components and assemblies, including barrel, mainspring, cannon pinion, endshake, sideshake, power reserve, drive train, calendar, winding system, power source
- adjusting components, assemblies/mechanisms to ensure operation/function to manufacturer specification using appropriate electronic timing and other diagnostic equipment and tools
- operational adjustments and verification including regulation, beat error, balance amplitude, rate, power supply

### Required knowledge

Look for evidence that confirms knowledge of:

- component parts, including mainspring, barrel, winding mechanism, electronic circuit, bridges, bearing surfaces, balance assembly, calendar, power source
- techniques and procedures for dismantling/removing components
- common/typical faults and maintenance requirements for common timepieces
- verification processes for condition/function of components of movement including balance assembly, escapement, endshakes, sideshakes, bridges, bearing surfaces, mainspring, barrel, winding mechanism, electronic circuit, freedom of wheel train
- fault-finding procedures
- typical faults caused by wear, blockages and other damage and their effects
- typical contaminants and their effects on operation/functioning of components, including contaminants and foreign objects
- lubricants and lubrication techniques
- cleaning requirements for ensuring correct operation
- OHS procedures for cleaning and maintenance
- techniques/tools for handling and installing components
- tools and techniques for assembling components
- safe work practices and safety measures
- required checks and procedures for verifying correct operation/function of components
- procedures/techniques for adjusting components
- operational specification for components and assemblies
- tools and equipment (mechanical and electronic) and their use/application

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to fault-find and maintain micro-mechanisms. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fault-finding and maintaining micro-mechanisms or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Micro-mechanism**

Mechanical and electric watches and clocks of recent manufacture, or restoration pieces. May include day/date, automatic winding or generating systems. Clock mechanisms may include alarm, striking and chiming mechanisms.

**Components**

Power source, wheel trains, mechanical oscillating systems, motion work and calendar systems

**Inspection**

- Observations of clearances, fits and adjustments, functioning
- Operation of systems and performance analysis

**Appropriate persons**

Customers, supervisors/managers/suppliers, technical experts, colleagues

**Tools and equipment**

Includes standard range of mechanical hand tools and electronic equipment to measure amplitude, rate etc.

**Specifications**

- Work performed to manufacturer specifications
- Recognition of components of product and how quality of component will affect performance

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Jewellery and horological
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## MEM19021B Diagnose and service micro-mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers diagnosing and servicing micro-mechanisms, including clocks and watches.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers the competencies required to diagnose and service micro-mechanisms. Work is undertaken autonomously or within a team environment using predetermined standards of quality, safety, workplace procedures and accepted workplace techniques/methods.</p> <p>This unit includes procurement and fitting of replacement parts. It also includes adjustment and checking to achieve timekeeping and water resistance of completed timepieces to specification/tolerance.</p> <p>If manufacturing of parts is required, the appropriate machining units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
Path 1	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM19020B	Fault-find and maintain micro-mechanisms

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify performance requirements for servicing	<p>1.1.Features and performance characteristics of micro-mechanism are identified.</p> <p>1.2.Performance problems common to make and model are identified.</p>

ELEMENT	PERFORMANCE CRITERIA
	1.3.Performance requirements for given task are identified and clarified with appropriate persons.
2. Diagnose faults and servicing requirements	2.1.Overall condition of micro-mechanism is assessed. 2.2.Physical condition and operational functioning of components inspected and verified, if necessary, with appropriate persons. 2.3.Servicing requirements are established with appropriate persons. 2.4.Performance problems are diagnosed and verified, if necessary, with appropriate persons. 2.5.Replacement parts are sourced according to enterprise procedures.
3. Service micro-mechanisms	3.1.Components are dismantled and cleaned to specification. 3.2.Requirements for new components are identified. 3.3.Components are refinished/replaced as required. 3.4.Components are assembled and lubricated to specification. 3.5.Components finished and adjusted to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying features and performance characteristics by critical observation of materials/design/finish
- identifying movement type
- identifying typical performance problems and special servicing requirements for given mechanism
- identifying missing/damaged components
- determining remedial action
- assessing casing components for wear/damage or missing parts
- using parts and movement catalogues
- determining sequence required for servicing, with reference to available parts,

**REQUIRED SKILLS AND KNOWLEDGE**

- design of product, nature of servicing requirement
- repair costing, including provision for replacement parts
- standard checks of assemblies and subassemblies, balance assembly, escapement, wheel train, motion work, power source (mainspring), calendar, winding and setting mechanisms
- checks for tensioning, functioning, cleanliness, clearances/tolerances, wear and damage
- verifying functioning of additional mechanisms e.g. auto-winding, generating systems, calendar mechanisms
- identifying faults affecting performance
- cleaning and refinishing components e.g. pivots
- selecting and applying correct lubricant based on materials used and torque requirements
- building assemblies and subassemblies
- fitting appearance parts
- evaluating water resistance of completed watch
- adjusting timekeeping to tolerance

**Required knowledge**

Look for evidence that confirms knowledge of:

- methods/media for identifying performance characteristics
- reasons for specific performance problems/faults e.g. wear, broken parts, fatigue, knocking
- faults in design or materials and special servicing requirements
- general condition features such as obvious damage, contaminants, rust etc.
- interchangeability of parts for specific timepiece
- factors affecting sequence/process for servicing
- techniques, tools and diagnostic equipment for diagnosing and identifying performance problems
- techniques for dismantling assemblies and subassemblies
- operation of equipment for refinishing pivots/bearing replacement
- techniques and procedures for assembling components, assemblies and subassemblies
- applications and use of different lubricants
- correct alignment of hands relating to date change mechanism and dial graduations
- adjusting timekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to diagnose and service micro-mechanisms. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with diagnosing and servicing micro-mechanisms or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Micro-mechanisms**

Mechanical and electric watches and clocks of recent manufacture, or restoration pieces. May include day/date, automatic winding or generating systems. Clock mechanisms may include alarm, striking and chiming mechanisms

**Components**

Power source, wheel trains, mechanical oscillating systems, motion work and calendar systems

**Inspection**

Observations of clearances, fits and adjustments, functioning. Operation of systems and performance analysis

**Appropriate persons**

Customers, supervisors/managers/suppliers, technical experts, colleagues

**Specifications**

Manufacturer specifications. Recognition of components of product and how quality of component and materials will affect performance

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Jewellery and horological
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# MEM19022B Perform precision micro-mechanism diagnosis and servicing

## Modification History

Not Applicable

## Unit Descriptor

<b>Unit descriptor</b>	This unit covers diagnosing and servicing precision micro-mechanisms including chronometer watch and clock components to achieve performance to original specifications.
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## Application of the Unit

<b>Application of the unit</b>	<p>This unit covers the competencies required to diagnose and service precision micro-mechanisms including chronometer watch and clock components to achieve performance to original specifications.</p> <p>Work is undertaken autonomously or within a team environment using predetermined standards of quality, safety, workplace procedures and accepted workplace techniques/methods.</p> <p>The unit includes precision adjustment and testing to achieve timekeeping and water resistance of completed timepieces to minimise error in performance within specification/tolerance.</p> <p>If manufacturing of parts is required, the appropriate machining units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM07005C	Perform general machining
	MEM09002B	Interpret technical drawing
	MEM12003B	Perform precision mechanical measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18003C	Use tools for precision work
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM19020B	Fault-find and maintain micro-mechanisms
	MEM19021B	Diagnose and service micro-mechanisms

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold
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unit of competency.	italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Adjust timing of precision micro-mechanisms	1.1.Data for precision timing of micro-mechanisms is analysed and interpreted. 1.2.Compensation/adjustment is made to achieve a constant rate.
2. Diagnose precision micro-mechanisms	2.1.Detailed inspection techniques are applied to diagnose and identify performance faults, condition and repair/servicing requirements. 2.2.High tolerance/precision tools and equipment are handled and used correctly.
3. Carry out precision micro-mechanism servicing	3.1.Precision components are replaced as appropriate. 3.2.Components are adjusted to precision tolerances and specifications.
4. Repair and adjust chronograph mechanisms	4.1.Functional elements are adjusted and tested. 4.2.Chronograph components are examined and re-finished as required.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- eliminating/minimising effects of internal external/external influences
- judging adequacy of accuracy
- making timing adjustments include balance spring, dynamic poising, static poising, truing balance (flat and round)
- making detailed observations using high-magnification optics

**REQUIRED SKILLS AND KNOWLEDGE**

- testing functioning of components to high tolerances including the functioning of escapement and oscillating system
- removing and replacing assembly and subassembly components including balance staff, pallet staff, pallet jewels and other precision components
- adjusting pallet jewels, safety action of escapement, poise of balance, manipulation of balance spring to minimise error in performance
- tensioning chronograph wheel and minute wheel
- observing and adjusting depth of engagement and operating sequence of functioning elements
- applying lubrication
- alignment of hands with dial
- re-finishing and matching components to existing components to ensure correct functioning
- fitting and adjusting new and repaired components to function within existing system

**Required knowledge**

Look for evidence that confirms knowledge of:

- physical limitations and condition of system and control factors influencing isochronism
- inherent influences in design, internal and external influences on rating variation
- adjustment procedures/techniques
- detailed inspection and analysis techniques for diagnosing precision micro-mechanisms
- acceptable tolerances, clearances and limits for precision components
- components suitable for precision outcomes
- effects of adjustment on performance and operation
- criteria for correct adjustment of balance spring and regulating system
- types of chronograph mechanisms and their functioning
- adjustment procedures for chronograph operation, including minute and hour recording systems

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform precision micro-mechanism diagnosis and servicing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing precision micro-mechanism diagnosis and servicing or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Micro-mechanisms</b>	Mechanical and electric precision watches and clocks of recent manufacture, or restoration pieces. Includes chronometer timepieces. May include day/date, automatic winding or generating systems. Clock mechanisms may include alarm, striking and chiming mechanisms
<b>Repair/servicing requirements</b>	<ul style="list-style-type: none"> <li>Repairs and timing adjustments include balance spring, dynamic poising, static poising, truing balance (flat and round)</li> <li>Repair and adjustment of chronograph mechanisms to ensure correct operation of seconds, minute and hour recording systems</li> </ul>
<b>Tools and equipment</b>	Range of precision mechanical/electronic tools and high-tolerance testing equipment for detailed observation diagnosis and servicing. Includes specialist service tools for adjusting oscillating systems and chronograph mechanisms
<b>Precision components</b>	<ul style="list-style-type: none"> <li>Timekeeping elements, including balance staff, pallet staff, pallet jewels, wheel trains and other precision components</li> <li>Power source, mechanical oscillating systems, motion work, calendar systems</li> </ul>
<b>Specifications</b>	<ul style="list-style-type: none"> <li>Precision adjustment performed to detailed manufacturer specifications and tolerances</li> <li>Account made of inherent influences in design, internal and external influences on rating variation</li> </ul>
<b>Tests</b>	<ul style="list-style-type: none"> <li>Observations of high-tolerance clearances, fits and adjustments and functioning</li> <li>Operation of systems and performance analysis</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Jewellery and horological
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# **MEM19023A Apply drawing and rendering techniques to jewellery or object design**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to use various drawing techniques in the jewellery or object design creative process. The unit covers conventions, language and forms of drawings and the role of drawings in communicating the tactile, visual and spatial features of a design.

## **Application of the Unit**

This unit applies to jewellery and object designers who are using drawings to develop and explore concepts as part of developing a jewellery or object design. The unit applies to both early and late stages of the design process and covers the role of drawing as a research, idea generation, interpretation and problem-solving tool. It also includes the use of drawing and drawing techniques as a means of representing and communicating the essential features of a design before finalisation and production.

The unit does not cover the production technical drawings intended to guide the manufacture of jewellery or objects by either the designer or others. Where this skill is required see MEM19031A Produce renderings and technical drawings for jewellery and object design construction. The unit also does not cover life drawing and the production of 3D computer-aided design (CAD) based models.

**Band A**

**Unit Weight 4**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Use drawing and rendering techniques to explore design options                           | 1.1 Demonstrate an understanding of the language and forms of drawing and rendering   |
|  | 1.2 Investigate the range of analytical, observational and imaginative drawing techniques for communication of design features and intent |
|  | 1.3 Explore design options through expressive and gestural drawing  |
|  | 1.4 Explore and sample marks, mark making and surface qualities in drawing  |
| 2 Explore tactile and visual qualities of drawing subject                                  | 2.1 Develop body, hand and eye coordination in relation to the act of drawing from observation  |
|  | 2.2 Complete a linear analysis of jewellery or object   |
|  | 2.3 Investigate shape, plane and volume in respect to jewellery or object   |
|  | 2.4 Interpret the effect of light on a form   |
|  | 2.5 Consider the picture plane and composition  |
|  | 2.6 Explore real and implied texture  |
| 3 Manipulate black and white and coloured drawing media in a creative and sensitive manner | 3.1 Explore and use a range of black and white media to develop design options  |
|  | 3.2 Explore and use a range of coloured media appropriate to develop design options   |
|  | 3.3 Use a range of papers and surfaces appropriate to development of design options   |
| 4 Use principles of perspective to illustrate spatial illusion                             | 4.1 Use principles of perspective to enhance the spatial illusion of jewellery or objects in space  |

4.2 Complete freehand perspective drawings showing evidence of an understanding of single, two and three point perspective

4.3 Illustrate views and projections appropriate to design

## Required Skills and Knowledge

Required knowledge includes:

- types and characteristics of media, materials and drawing surfaces
- drawing equipment and applications, storage and maintenance
- role of shape, plane and volume in drawing and rendering
- elements and principles of design
- mathematical procedures for estimation and measurement
- 2D and 3D drawing techniques
- occupational health and safety (OHS) requirements

Required skills include:

- exploring, selecting and manipulating a range of media, materials and drawings
- exploring marks and mark making
- drawing from observation
- using perspective in drawing
- applying a range of drawing techniques, such as line drawing, contour drawing and gesture drawing
- drawing to create spatial illusion
- using shape, plane and volume in drawing and rendering
- creating texture in drawing (real and implied)
- applying black and white and coloured rendering techniques
- applying composition techniques
- applying rendering applications and techniques and tools for the creation of illustration effects
- expressing self through intuitive and expressive drawing

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of drawing techniques to illustrate perspectives and features of jewellery or object designs.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• demonstrate analytical, observational and imaginative drawing techniques to demonstrate features of jewellery or object designs</li> <li>• produce drawings of jewellery or object designs from single, two and three point perspectives</li> <li>• use drawing tools, materials and techniques to communicate the design features.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Design features</b>	<p>Design features may include:</p> <ul style="list-style-type: none"> <li>• materials</li> <li>• dimensions</li> <li>• context</li> <li>• purpose</li> </ul>
<b>Media, materials and drawing surfaces</b>	<p>Media, materials and drawing surfaces may include:</p> <ul style="list-style-type: none"> <li>• pencils</li> <li>• ink (brush, pen and wash)</li> <li>• charcoal (natural and compressed)</li> <li>• conte</li> <li>• crayon</li> <li>• gouache</li> <li>• coloured pencils</li> <li>• felt tip markers</li> <li>• paper (a range of weights, textures and colours)</li> <li>• collage</li> <li>• paints</li> </ul>
<b>Rendering</b>	<p>Rendering is to include, but not be limited to:</p> <ul style="list-style-type: none"> <li>• the pictorial representation of aspects and perspectives using colours, highlighting and shading to provide depth and photo-like drawings</li> </ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19024A Use CAD to create and display 3D jewellery and object models**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to use a computer-aided design (CAD) program to produce 3D drawings of jewellery and object models.

### **Application of the Unit**

This unit applies to jewellery and object designers who are using CAD software and equipment to generate and document jewellery and object designs. Documentation may be used to inform production of jewellery or objects and incorporates standard practice notations and drawing protocols.

**Band A**

**Unit Weight 4**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Determine project requirements                             | <ul style="list-style-type: none"><li>1.1 Ensure applicable occupational health and safety (OHS), legislative and organisational requirements relevant to CAD applications are verified and complied with</li><li>1.2 Review jewellery or object design brief and parameters to determine drawing and documentation requirements</li><li>1.3 Examine sketches, drawings and other information and confirm calculations and measurements</li><li>1.4 Select and prepare computing equipment and suitable software for jewellery or object designs</li></ul>  |
| 2 Use CAD applications to produce 3D model and documentation | <ul style="list-style-type: none"><li>2.1 Set up a 3D environment on the screen to allow multiple viewing</li><li>2.2 Use editing tools to create features and dimensions of jewellery or object</li><li>2.3 Manipulate drawing planes and shapes to create 3D view of jewellery or object</li><li>2.4 Produce isometric, perspective and orthographic projections</li><li>2.5 Extract mass and area properties of jewellery or object model</li><li>2.6 Use principles of perspective to enhance the spatial illusion of jewellery or objects in space</li><li>2.7 Apply basic rendering techniques to 3D model of jewellery or object</li><li>2.8 Apply drawing protocols to refine and document drawing features</li></ul> |
| 3 Save and back up files                                     | <ul style="list-style-type: none"><li>3.1 Determine appropriate presentation for jewellery or object drawings</li><li>3.2 Save and file drawings to allow easy access according to workplace documentation system</li></ul>   |

## Required Skills and Knowledge

Required knowledge includes:

- state or territory OHS legislation, regulations, standards and codes of practice relevant to the full range of processes for using CAD applications
- elements and principles of design
- terminology and symbols used in drawings and CAD software
- types of CAD equipment and procedures for their safe use, operation and maintenance
- computer programs and CAD applications
- drafting and drawing codes and practices relevant to jewellery and object design
- 2D and 3D drawing techniques
- appropriate mathematical procedures for estimation and measurement
- documentation control procedures
- problem identification and resolution techniques
- jewellery and object design and construction techniques
- rendering applications and techniques and tools for the creation of illustration effects
- region modelling techniques
- solid modelling techniques
- development of sectioned models
- use of cutting plane
- use of cross hatching
- use of pre-drawn library files and primitives to produce 3D models
- use of third level software to produce 3D models
- how to extract mass and area properties
- how to extract area properties from region models
- application of basic rendering techniques to a 3D model

Required skills include:

- communicating ideas and information to enable confirmation of work requirements and specifications
- reading and interpreting workplace documents, including working drawings
- using mathematical ideas and techniques to correctly complete measurements, calculate area and volume, and estimate other material requirements
- attending to detail
- planning own work within the given task parameters
- using workplace technology, including calculators, measuring and recording devices, and computing equipment



## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use a CAD program to produce 3D drawings and perspectives of jewellery or object designs.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• demonstrate accurate CAD techniques to create and display features of jewellery or object designs</li> <li>• produce 3D CAD models of jewellery or object designs from single, two and three point perspectives</li> <li>• communicate effectively and work safely with others in the work area.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Design features</b>	Design features may include: <ul style="list-style-type: none"><li>• materials</li><li>• dimensions</li><li>• colours</li><li>• shapes</li></ul>
<b>Multiple viewing</b>	Multiple viewing includes: <ul style="list-style-type: none"><li>• top views</li><li>• front and side views</li><li>• general 3D view</li></ul>
<b>Shapes</b>	Shapes may include: <ul style="list-style-type: none"><li>• arcs and lines</li><li>• spheres</li><li>• cones</li><li>• cylinders</li><li>• boxes</li></ul>
<b>Rendering</b>	Rendering is to include, but not be limited to: <ul style="list-style-type: none"><li>• the pictorial representation of aspects and perspectives using colours, highlighting and shading to provide depth and photo-like effects</li></ul>
<b>Drawing protocols</b>	Drawing protocols are to include, but not be limited to: <ul style="list-style-type: none"><li>• commonly used symbols</li><li>• lettering standards</li><li>• standard units of measurement</li><li>• scale</li><li>• numbering</li><li>• legends</li><li>• abbreviations</li></ul>

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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19025A Create and present designs for jewellery and other 3D objects**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply creative processes to develop and present a jewellery or object design solution which responds to a specific design brief.

### **Application of the Unit**

This unit applies to designers who are responsible for creating a jewellery or object design which meets specific client needs. The design solution must be developed and presented in a manner which confirms all features of the item.

**Band A**

**Unit Weight 4**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Prepare for design process                 | <ul style="list-style-type: none"><li>1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area</li><li>1.2 Confirm design brief and parameters with client or relevant personnel</li><li>1.3 Analyse jewellery or object design brief to determine implications for design process</li><li>1.4 Develop work plan of activities which identifies and prioritises tasks</li><li>1.5 Identify and collect required data</li><li>1.6 Select and prepare appropriate media and equipment</li></ul>   |
| 2 Apply design processes to develop concepts | <ul style="list-style-type: none"><li>2.1 Conduct research to inform generation of ideas and design concepts for jewellery or object</li><li>2.2 Complete drawings to develop ideas and gain perspectives and views for jewellery or object</li><li>2.3 Develop design concepts with consideration to elements and principles of design</li><li>2.4 Consider a range of specialist jewellery and object production techniques and apply to design concepts</li><li>2.5 Apply knowledge of jewellery or object materials for the development of design concepts and determine most suitable options</li><li>2.6 Apply creative processes to develop and refine jewellery or object design concepts</li></ul> <p style="margin-left: 40px;">Establish basic forms and proportions</p> |
| 3 Revise and refine design solution          | <ul style="list-style-type: none"><li>3.1 Assess concepts for viability and adherence to design brief</li><li>3.2 Discuss concepts with client or relevant personnel and integrate feedback</li><li>3.3 Select and refine design solution</li><li>3.4 Develop work plan of activities and design specifications</li><li>3.5 Document design process</li></ul>   |

- 4 Document and present design solution
- 4.1 Prepare documentation and drawings of design solution to clearly demonstrate features and specifications
  - 4.2 Present design solution to client or relevant personnel and seek feedback
  - 4.3 Evaluate design process and outcomes to determine success in meeting design brief

## Required Skills and Knowledge

Required knowledge includes:

- research resources and techniques for investigating design information
- elements and principles of design as they relate to design of jewellery and objects
- working properties of jewellery materials
- methods of production for jewellery and objects
- design resources
- brainstorming and other idea generation techniques for research/idea development
- drawing media and their functions/applications, including paper, watercolours and pastels/inks/pencils
- computer drawing/design software (e.g. Photoshop, Illustrator and Indesign)
- form drawing development
- options available for drawing presentation
- enhancement techniques
- types of working drawings and their uses
- the interrelation between technical and design drawings
- hazard and control measures associated with preparing jewellery designs
- safe work practices

Required skills include:

- interpreting and clarifying a design brief
- identifying and collecting information necessary to create design concepts
- drawing
- developing and refining ideas
- applying principles and elements of design
- reading and interpreting information on specifications, design documentation, illustrations, design drawings and other applicable source documents
- identifying purpose and needs, including design considerations, item end use, proportions and desired features, and available materials
- checking and clarifying information
- developing research/idea to sufficient level in order to determine client expectations and/or

design outcomes

- evaluating abstract and applied concepts/data
- collecting and collating data relevant to design
- communicating concepts in terms suitable to clients
- documenting and maintaining design process, features and design development notes
- producing basic form drawings that accurately reflect design concept
- using drawing and/or rendering techniques appropriately
- undertaking numerical operations, geometry and calculations within the scope of the unit
- carrying out work according to OHS practices

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of creative processes to develop and refine design concepts and present a design solution which meets the parameters of a design brief.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices</li> <li>• analyse a design brief and determine key parameters</li> <li>• apply creative processes to develop and refine design concepts</li> <li>• apply knowledge of materials and production processes to jewellery and object design</li> <li>• prepare and present design concepts to appeal to the specific needs of the intended audience</li> <li>• evaluate success of design in meeting design brief.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>

<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li><li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li><li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li><li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li><li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment may be in conjunction with assessment of other units of competency where required.</li></ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Design features</b>	Design features may include: <ul style="list-style-type: none"><li>• materials</li><li>• dimensions</li><li>• scale</li><li>• special requirements</li><li>• finish</li><li>• texture</li><li>• balance</li><li>• contrast</li><li>• composition</li><li>• layers</li></ul>
<b>Design parameters</b>	Design parameters may include: <ul style="list-style-type: none"><li>• materials, stones and gems</li><li>• colours</li></ul>



	<ul style="list-style-type: none"><li>• historical and cultural features</li><li>• context</li><li>• function</li><li>• purpose</li><li>• size and shape</li><li>• cost</li></ul>
<b>Specialist techniques</b>	Specialist techniques may include: <ul style="list-style-type: none"><li>• anodising</li><li>• patination</li><li>• other surface treatments</li><li>• enamelling</li><li>• married metals</li><li>• mokume gane</li><li>• fusion</li><li>• forging</li><li>• stone setting</li><li>• hollow forming</li></ul>
<b>Creative processes</b>	Creative processes may include: <ul style="list-style-type: none"><li>• drawing and illustration using manual or computer aided methods</li><li>• application of specialist techniques</li><li>• experimentation</li><li>• manipulation</li><li>• research</li><li>• modelling</li><li>• collaboration</li><li>• brainstorming, lateral thinking, problem definition and problem solving</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• manager</li><li>• trainer</li><li>• mentor</li><li>• teacher</li><li>• team member</li></ul>
<b>Design documents</b>	Design documents may include: <ul style="list-style-type: none"><li>• sketches</li><li>• illustrations</li><li>• concept drawings</li><li>• working drawings</li></ul>

	<ul style="list-style-type: none"><li>• technical/digital data</li><li>• supporting information</li></ul>
<b>Elements and principles of design</b>	Elements and principles of design may include: <ul style="list-style-type: none"><li>• construction techniques</li><li>• construction limitations of materials</li><li>• drawing to scale for designs</li><li>• form, function, line, balance colour, harmony, line definition (interpretive/actual), shape, mass, proportion, movement, texture, repetition, space, rhythm, contrast, composition and scale</li></ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19026A Investigate quality and application of jewellery materials**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to investigate the quality of materials used in jewellery construction and their applications in order to inform design and production. It includes conducting research into materials and selecting materials according to construction and design requirements.

### **Application of the Unit**

This unit applies to those involved in jewellery construction as makers and/or designers who require a working knowledge of the benefits and limitations of materials used. It includes recognition of quality assessment processes and industry standardisation in order to identify quality of materials. Materials may also be used in construction of decorative objects.

**Band A**

**Unit Weight 2**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |  |  |
|--|--|
| 1 Research jewellery materials                           | <ul style="list-style-type: none"><li>1.1 Identify materials typically used in jewellery construction and their range of uses</li><li>1.2 Identify information sources and specialist expertise available to confirm uses and quality of materials</li><li>1.3 Identify source/origin of materials and processes involved in extraction or development and known environmental impacts</li><li>1.4 Identify recovery and recycling opportunities for materials used in jewellery</li><li>1.5 Assess risk factors in using materials for various jewellery applications</li><li>1.6 Select materials for construction of jewellery according to design, work and quality requirements</li></ul> |
| 2 Apply knowledge of metals to jewellery construction    | <ul style="list-style-type: none"><li>2.1 Describe the qualities, features, limitations and working characteristics of different metals used in jewellery</li><li>2.2 Describe industry standards of purity for precious metals and the marking system used to identify grade of quality</li><li>2.3 Describe the process of making metal alloys and impact of mix on final properties</li><li>2.4 Conduct basic tests to assess purity of metal</li><li>2.5 Determine costing implications of using metals of various purity in jewellery</li><li>2.6 Select metals for construction of jewellery according to design, work and quality requirements</li></ul>                                |
| 3 Apply knowledge of gemstones to jewellery construction | <ul style="list-style-type: none"><li>3.1 Identify types of gemstones and their key characteristics</li><li>3.2 Identify processes used to determine quality of gemstones and interpret industry standards</li><li>3.3 Identify range of facet cuts used on gems and range of applications in jewellery design</li><li>3.4 Identify techniques used to enhance lower quality gemstones</li><li>3.5 Determine costing implications of using various</li></ul>   |

gemstones in jewellery

3.6 Identify requirements for handling and cleaning gemstones

3.7 Select gems for construction of jewellery according to design, work and quality requirements

4 Apply safe work practices in handling materials

4.1 Conduct risk assessment for materials and processes to be used in construction

4.2 Identify characteristics of chemicals and hazardous materials used in construction and ensure workplace safety procedures are applied

4.3 Access, interpret and apply material safety data sheets (MSDS) and labelling information

4.4 Use protective equipment required for handling and manipulating materials

## Required Skills and Knowledge

Required knowledge includes:

- melting points of various metals/alloys
- properties of jewellery metals
- nomenclature used in describing and identifying jewellery materials
- physical and optical properties of gem materials
- uses and characteristics of less common materials used in jewellery
- industry standards for quality of materials
- safe work practices

Required skills include:

- identifying metals and their alloys
- measuring and handling gemstones
- recognising the range of materials used in jewellery
- interpreting industry technical information
- conducting research and accessing information to inform work
- applying quality standards to work
- undertaking numerical operations, geometry and calculations within the scope of the unit
- carrying out work according to occupational health and safety (OHS) practices

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to identify the features of materials used in jewellery construction and the processes used to confirm quality, and apply this knowledge in the selection and use of materials in the construction of jewellery items.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• analyse and apply industry standards and information on material quality and grades</li><li>• select materials to meet the needs of work outcomes</li><li>• apply knowledge of metals and gemstones to work processes.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li><li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li><li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li><li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li><li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li><li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to</li></ul>

	<p>other circumstances.</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>gemstones (e.g. diamonds, rubies, sapphires and emeralds)</li> <li>ornamental materials (e.g. lapis lazuli and malachite)</li> <li>biological gem materials (e.g. amber, coral and ivory) and their synthetics and imitations</li> <li>rocks</li> <li>non-crystalline materials (e.g. amorphous opal)</li> <li>glass, plastic and composite stones</li> <li>gold, silver, platinum, palladium, copper and their alloys</li> </ul>
<b>Qualities of materials</b>	<p>Quality of materials may include:</p> <ul style="list-style-type: none"> <li>malleability</li> <li>ductility</li> <li>conductivity</li> <li>strength</li> <li>reaction to treatments and construction processes</li> </ul>
<b>Information sources and specialist expertise</b>	<p>Information sources and specialist expertise may include:</p> <ul style="list-style-type: none"> <li>industry associations</li> <li>Australian standards documentation</li> <li>gemmologists</li> <li>trade publications</li> <li>internet</li> <li>suppliers</li> </ul>
<b>Types of gemstones</b>	<p>Types of gemstones includes:</p> <ul style="list-style-type: none"> <li>diamonds</li> <li>beryl</li> <li>quartz</li> </ul>

	<ul style="list-style-type: none"><li>• agate</li><li>• opal</li><li>• jade</li></ul>
<b>Basic tests to assess purity of metal</b>	Basic tests to assess purity of metal may include: <ul style="list-style-type: none"><li>• acid testing</li><li>• touch stone</li><li>• electronic testing</li></ul>
<b>Gem characteristics</b>	Gem characteristics may include: <ul style="list-style-type: none"><li>• beauty</li><li>• durability</li><li>• rarity</li><li>• cost</li><li>• colouring</li><li>• size</li><li>• shape</li></ul>
<b>Facet cuts used on gems</b>	Facet cuts used on gems include: <ul style="list-style-type: none"><li>• emerald</li><li>• pear cut</li><li>• round brilliant</li><li>• asscher cut</li><li>• cushion cut</li><li>• oval cut</li><li>• radiant cut</li><li>• marquise cut</li><li>• princess cut</li><li>• heart cut</li></ul>
<b>Treatments and enhancement of gems</b>	Treatments and enhancement of gems may include: <ul style="list-style-type: none"><li>• heat treatment</li><li>• oiling</li><li>• irradiation</li><li>• coating</li><li>• colouring</li></ul>

## Unit Sector(s)

Jewellery and horological



## Custom Content Section

Not applicable.

## **MEM19027A Produce life drawings for presenting jewellery and object designs**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skill and knowledge required to produce drawings which present jewellery and object designs on the human figure in a manner which demonstrates design features.

### **Application of the Unit**

This unit applies to jewellery and object designers who are using drawings to explore and demonstrate the relationship of jewellery and objects with the human figure. It includes application of a range of drawing techniques and media and production of hand drawn representations from a life model.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM19023A Apply drawing and rendering techniques to jewellery or object design

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |                       |  |
|-----------------------|--|
| 1 Prepare for drawing | 1.1 Select and prepare drawing tools for drawing and |
|-----------------------|--|

- establish drawing position for desired perspective
- 1.2 Prepare life model to achieve desired lighting, angle and position
- 1.3 Examine model to assess features, such as shape, shading, dimension and perspective
- 1.4 Assess the total figure in regard to totality of figure and consider gesture, flowing lines, proportion and structure
- 2 Draw the human figure from life model
  - 2.1 Apply drawing techniques to draw expressive human figure
  - 2.2 Apply elements of design to show gesture, rhythm and movement
  - 2.3 Apply drawing techniques to achieve structure, proportion and balance
  - 2.4 Represent head, hands and feet in illustration with focus on detail
- 3 Explore relationship of jewellery and objects with human form
  - 3.1 Experiment with a variety of media, materials and techniques to represent jewellery and objects on the human form
  - 3.2 Analyse the effects of different representations and their strengths and limitations in presenting jewellery and objects
  - 3.3 Analyse the relationship of jewellery and objects to the human form and demonstrate relationship through drawings
- 4 Present jewellery or objects on the human form
  - 4.1 Select media, materials and techniques for presenting specific pieces of jewellery or object
  - 4.2 Complete life drawing with jewellery or object
  - 4.3 Present drawing and identify key features and elements demonstrated
  - 4.4 Seek and integrate feedback on drawing

## Required Skills and Knowledge

Required knowledge includes:

- types and characteristics of media, materials and drawing surfaces
- drawing equipment and applications, storage and maintenance
- role of shape, plane and volume in drawing and rendering
- elements and principles of design
- features and effects of materials and forms used in jewellery and object designs
- mathematical procedures for estimation and measurement
- 2D and 3D drawing techniques
- occupational health and safety (OHS) requirements

Required skills include:

- applying a range of hand drawing techniques, such as line drawing, gesture drawing and contour drawing
- interpreting and representing
- exploring, selecting and manipulating of a range of media, materials and drawing styles
- using shape, plane and volume in drawing and rendering
- creating texture in drawing (real and implied)
- applying black and white and coloured rendering techniques
- applying composition techniques
- using rendering applications and techniques and tools for the creation of illustration effects
- expressing self through intuitive and expressive drawing

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of drawing techniques to illustrate perspectives and features of jewellery or object designs in relationship with the human form.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• demonstrate analytical, observational and imaginative drawing techniques to represent features of jewellery or object designs on the human figure</li> <li>• produce expressive figure drawings from life model</li> <li>• use drawing tools, materials and techniques to communicate relationship of jewellery and objects to the human form.</li> </ul>

<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Media, materials and drawing materials</b>	<p>Media, materials and drawing materials may include:</p> <ul style="list-style-type: none"> <li>• pencils</li> <li>• ink (brush, pen and wash)</li> <li>• charcoal (natural and compressed)</li> <li>• conte</li> <li>• crayons</li> <li>• gouache</li> <li>• coloured pencils</li> <li>• felt tip markers</li> <li>• paper (a range of weights, textures and colours)</li> </ul>
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	<ul style="list-style-type: none"><li>• collage</li><li>• paints</li><li>• multimedia</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19028A Select materials and new technologies for jewellery and 3D object design applications**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select materials and technologies for jewellery and 3D object design applications. It includes evaluating the benefits and limitations of different materials and technologies and determining best options to meet specific design and application requirements.

### **Application of the Unit**

This unit applies to designers of jewellery and 3D objects. Application of this unit includes selection of materials and technologies to suit individual handcrafted designs or mass production.

**Band A**

**Unit Weight 2**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Select materials for jewellery or object applications                                | <ul style="list-style-type: none"><li>1.1 Identify properties, features and typical applications of metals and metal alloys used in jewellery or objects</li><li>1.2 Identify properties, features and typical applications of alternative materials used in jewellery or objects</li><li>1.3 Evaluate materials for suitability and compatibility against jewellery or object design requirements, product descriptions and/or drawings</li><li>1.4 Consider benefits and limitations of working with or adding alternate materials against the design brief</li><li>1.5 Identify and compare alternative options and, if necessary, consult with appropriate persons</li><li>1.6 Select final materials based on design requirements, design considerations, drawings, product description, principal material properties and processing requirements</li><li>1.7 Confirm selection of materials with appropriate persons</li></ul> |
| 2 Select manufacturing technologies and processes for jewellery or object applications | <ul style="list-style-type: none"><li>2.1 Identify jewellery or object manufacturing technologies and processes suitable to jewellery and 3D object production</li><li>2.2 Identify manufacturing technologies and processes suited to specific jewellery and 3D object applications and materials</li><li>2.3 Consider capabilities and limitations of different technologies and processes against design brief and other design considerations</li><li>2.4 Identify and compare alternative technologies and processes and, if necessary, consult with appropriate persons</li><li>2.5 Select manufacturing technologies and processes based on design requirements, design considerations, drawings, product description and appropriateness to selected materials</li><li>2.6 Confirm selection of jewellery or object manufacturing technologies and processes with appropriate personnel</li></ul>                             |



- 3 Finalise drawing for presentation
- 3.1 Select drawing presentation and production technique to enhance impact of jewellery or object design features and to appeal to the intended audience
  - 3.2 Use/store/file/copy/issue working and reference drawings/illustrations in accordance with standard operating procedures
  - 3.3 Prepare supporting information to accompany drawing, as required

## Required Skills and Knowledge

Required knowledge includes:

- properties and features and typical applications of precious metals and alloys, base and refractory metals
- types of alternative materials
- advantages and drawbacks of particular materials
- properties and features and typical applications of alternative materials
- manufacturing technologies and processes suitable to jewellery and 3D object production
- advantages and drawbacks of different technologies and processes

Required skills include:

- identifying design requirements and design considerations
- matching materials and technologies to design requirements and design considerations
- comparing and evaluating various materials and technologies

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of drawing techniques to demonstrate features of jewellery or object construction and prepare drawing for presentation according to the audience needs.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• apply OHS workplace procedures and practices, including the use of risk control measures</li><li>• identify benefits and limitations of materials and</li></ul>

	<p>manufacturing processes in achieving outcomes in jewellery and object design applications</p> <ul style="list-style-type: none"> <li>• select materials for jewellery and 3D object applications</li> <li>• select manufacturing technologies and processes for jewellery and 3D object applications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>Features and properties</b>	Features and properties may include: <ul style="list-style-type: none"><li>• physical properties and behaviour</li><li>• visual appearance</li><li>• colour</li><li>• availability/rarity</li></ul>
<b>Design considerations</b>	Design considerations may include: <ul style="list-style-type: none"><li>• cost/economic viability</li><li>• policy/preference</li><li>• manufacturing requirements</li><li>• aesthetic value</li><li>• relevance to the design proposal</li><li>• practicality</li><li>• safety</li><li>• ergonomics</li><li>• cultural and social influences</li><li>• sustainability</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• manager</li><li>• trainer</li><li>• mentor</li><li>• teacher</li><li>• team member</li><li>• client</li></ul>
<b>Metals</b>	Metals may include: <ul style="list-style-type: none"><li>• precious metals and alloys</li><li>• base metals</li><li>• refractory metals</li></ul>
<b>Alternative materials</b>	Alternative materials may include: <ul style="list-style-type: none"><li>• plastics and polymers</li><li>• resins</li><li>• ceramics</li><li>• composites</li><li>• synthetic materials</li><li>• naturally found objects</li><li>• wood</li><li>• rubber</li></ul>

	<ul style="list-style-type: none"> <li>• silicon</li> <li>• glass</li> </ul>
<b>Manufacturing technologies and processes</b>	<p>Manufacturing technologies and processes may include:</p> <ul style="list-style-type: none"> <li>• water jet and laser cutting</li> <li>• casting (clay, vacuum and centrifugal)</li> <li>• pressing and stamping</li> <li>• forging</li> <li>• welding</li> <li>• rolling and extruding</li> <li>• machining</li> <li>• spinning</li> <li>• anodising and electroplating</li> <li>• powder coating</li> <li>• moulding</li> <li>• rapid prototyping</li> </ul>
<b>Occupational health and safety (OHS) requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>

## **Unit Sector(s)**

Jewellery and horological

## **Custom Content Section**

Not applicable.

## **MEM19029A Produce a professional jewellery design and 3D object portfolio**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design and compile a folio of jewellery or 3D objects. The purpose of the folio may relate to career promotion, sales and marketing, historical record or reference.

### **Application of the Unit**

This unit applies to the compilation of a folio showcasing personal jewellery or 3D object works or those of a client. It includes using images the present works both on and off the body. This unit does not cover the manufacture of such objects. If items are to be manufactured, then appropriate units should also be selected.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |                                 |  |
|---------------------------------|--|
| 1 Develop design folio concepts | 1.1 Establish the purpose and objectives of a design folio   |
|                                 | 1.2 Research concepts or presentation styles and select ideas/concepts appropriate for the purpose and function of the jewellery or object |

presentation material

- 1.3 Document ideas and concept development using a range of media
- 1.4 Identify constraints and limitations in presenting jewellery or objects in various formats on and off the body, and determine implications for folio concept
- 1.5 Select folio concept based on practical considerations and appropriateness to function, purpose and objectives of jewellery or objects to be displayed
- 2 Collect and prepare source materials
  - 2.1 Collect and prepare drawings, sketches, jewellery, objects and works for photographing/illustrating or other processing
  - 2.2 Select images that present works on and off the body to portray key features of the item
  - 2.3 Select display formats for individual items/folio elements to emphasise message and meaning
  - 2.4 Obtain resources for producing design folio
  - 2.5 Produce design documentation, as required, using appropriate media and formats
- 3 Compile design folio
  - 3.1 Arrange and sequence folio elements for required visual effect
  - 3.2 Confirm that the completed folio is consistent with aims and objectives
  - 3.3 Check the completed folio for accuracy of content and consistency of arrangement, layout and style
  - 3.4 Ensure adherence to protocols, conventions and industry standards

## Required Skills and Knowledge

Required knowledge includes:

- purpose and applications of design folios
- techniques for idea/concept development
- research techniques
- arranging and sequencing elements for effect
- protocols, conventions and industry standards
- techniques/manufacturing methods for jewellery/3D object production

Required skills include:

- experimenting with media, designs, layout and presentation styles
- applying idea generation and concept development techniques
- researching information
- preparing design documentation

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to develop a design portfolio of jewellery and 3D objects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine options for presentation of jewellery and 3D objects in a folio context</li> <li>• produce a design folio which demonstrates key features of jewellery or 3D objects according to the intended purpose of the folio.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning</li> </ul>



	<p>knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Occupational health and safety (OHS) requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislative and regulatory requirements</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> </ul>
<b>Design documentation</b>	<p>Design documentation may include:</p> <ul style="list-style-type: none"> <li>• freehand and technical drawings</li> <li>• computer generated designs</li> <li>• developmental sketches</li> <li>• illustrations</li> <li>• concept rationale</li> <li>• notations</li> <li>• concept rationale</li> <li>• concept statement</li> <li>• mounted renderings</li> <li>• photographs</li> <li>• specifications</li> <li>• technical data, including manufacturing processes, materials, specifications and costings</li> <li>• bibliography</li> <li>• testimonials</li> <li>• work experience</li> </ul>

<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• photographic equipment, accessories and media</li><li>• drawing equipment and media</li><li>• mounting equipment</li><li>• measuring equipment</li><li>• consumables</li></ul>
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## **Unit Sector(s)**

Jewellery and horological

## **Custom Content Section**

Not applicable.

## **MEM19030A Research and design sustainable objects**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design products that take into consideration environmental conservation, resources utilisation and sustainable development.

### **Application of the Unit**

This unit is applied to production using sustainable materials, techniques and practices and incorporating them into contemporary product and/or object manufacture.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |   |  |
|---|--|
| 1 Explain basic concepts relating to environmental conservation, resources utilisation and sustainable design | 1.1 Describe the basic principles of environmental conservation          |
|   | 1.2 Identify and analyse a product that makes efficient use of resources |
|   | 1.3 Describe the basic principles of                                     |

## sustainable design

- |   |  |
|---|--|
| <p>2 Develop and utilise product design processes that promote positive environmental outcomes</p> <p>3 Recommend appropriate materials and processes to minimise the impact on the environment</p> | <p>2.1 Develop criteria to select materials and processes that promote environmental conservation</p> <p>2.2 Document the manufacturing and materials processes used in the production of a simple product</p> <p>2.3 Identify substitute materials and manufacturing processes that would make more efficient use of resources</p> <p>2.4 Recommend materials and processes that minimise materials and energy usage</p> <p>3.1 Define the main benefits of using sustainable materials and processes</p> <p>3.2 Qualify the main benefits</p> <p>3.3 Document research sources fully</p> |
|---|--|

## Required Skills and Knowledge

Required knowledge includes:

- environmental conservation
- resource utilisation
- sustainability
- design processes
- simple material selection processes
- basic product design production processes
- creation and utilisation of appropriate criteria for materials and manufacturing process selection
- common features of design specifications
- commonly used research methodologies
- report writing
- management of time and resources
- effective workplace communication strategies and techniques
- workplace occupational health and safety (OHS) principles and processes

Required skills include:

- conducting research

- communicating research findings
- evaluating sustainability credentials of relevant source materials and completing design documentation
- planning and organising
- interpreting and responding to design criteria
- solving problems sufficiently to identify, rank and recommend appropriate solutions

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to conduct research into issues of sustainability for jewellery and object design and analyse findings to inform work decisions.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• apply sustainable design principles and practices</li> <li>• comply with the design brief requirements</li> <li>• create and utilise appropriate criteria</li> <li>• undertake relevant research and document findings and application of sustainability principles.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with</li> </ul>

	<p>application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Principles of environmental conservation</b>	<p>Principles of environmental conservation may include:</p> <ul style="list-style-type: none"> <li>• sustainable materials sourcing practices</li> <li>• reducing energy consumption</li> <li>• re-using materials or components</li> <li>• recycling components</li> <li>• compliance with local, national and international legislation</li> <li>• promoting safety in production, use, maintenance and disposal</li> <li>• minimising pollution</li> <li>• carbon neutral production and off-sets</li> <li>• protection of ecosystems</li> </ul>
<b>Principles of sustainable design</b>	<p>Principles of sustainable design may include:</p> <ul style="list-style-type: none"> <li>• life cycle assessment</li> <li>• life cycle energy analysis</li> <li>• recycling products</li> <li>• re-using products or components</li> <li>• utilising renewable resources</li> <li>• minimising damage to ecosystems</li> <li>• reducing loss of biodiversity</li> </ul>

	<ul style="list-style-type: none"> <li>• substitution of new more efficient technologies</li> <li>• reducing pollution</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Criteria</b>	<p>Criteria may relate to:</p> <ul style="list-style-type: none"> <li>• research data</li> <li>• ethical design practices</li> <li>• team discussions</li> <li>• negotiation of priorities</li> <li>• weighting of criteria</li> <li>• flow chart</li> </ul>
<b>Efficient use of resources</b>	<p>Efficient use of resources may include:</p> <ul style="list-style-type: none"> <li>• minimising waste</li> <li>• using renewable resources</li> <li>• minimising use of non-renewable resources</li> <li>• reduction in total cost of production</li> <li>• re-use</li> <li>• recycle</li> <li>• redesign</li> <li>• margin of safety</li> <li>• factor of safety</li> </ul>
<b>Recommending materials and processes</b>	<p>Recommending materials and processes may involve:</p> <ul style="list-style-type: none"> <li>• material specifications</li> <li>• manufacturing processes</li> <li>• production costs</li> <li>• quality control</li> <li>• design specification</li> <li>• written notes with rationale or description</li> <li>• health and safety considerations</li> </ul>
<b>Defining the main benefits</b>	<p>Defining the main benefits may include:</p> <ul style="list-style-type: none"> <li>• diagrams</li> <li>• ranking benefits</li> <li>• document empirical evidence</li> <li>• drawings or sketches (manual or computer-aided)</li> </ul>

	<ul style="list-style-type: none"><li>design (CAD) and drafting</li><li>• electronic presentations</li><li>• illustrations</li><li>• layouts</li><li>• mock-ups</li><li>• models</li><li>• plans</li><li>• verbal presentations</li><li>• written notes with rationale or description</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.



# **MEM19031A Produce renderings and technical drawings for jewellery and object design construction**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required by a designer to produce renderings and technical drawings to enable construction of their design.

## **Application of the Unit**

This unit applies to designers who must produce renderings and technical drawings of their design to facilitate construction by themselves or others. The unit presumes that the design is finalised. The drawings and renderings would typically be used by the designer to develop production concepts, for marketing, or to record details necessary for construction by self or others.

Where the production of jewellery illustrations is required for practical application or trade work, such as manufacturing, modifying or repairing jewellery items, see MEM19002B Prepare jewellery illustrations.

**Band A**

**Unit Weight 2**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |                                     |  |
|-------------------------------------|--|
| 1 Identify drawing requirements     | <ul style="list-style-type: none"><li>1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area</li><li>1.2 Analyse jewellery or object design to determine types of drawings, views and specifications required</li><li>1.3 Identify and collect required data</li><li>1.4 Select appropriate media and equipment</li></ul>  |
| 2 Produce drawing or render         | <ul style="list-style-type: none"><li>2.1 Adhere to OHS requirements for carrying out the work</li><li>2.2 Plan the stages, materials, tools and equipment for drawing or render</li><li>2.3 Produce drawing or render in a manner that maximises jewellery or object design features while conveying technical details necessary for construction</li><li>2.4 Apply drawing protocols as required to specify construction details and dimensions</li><li>2.5 Check and confirm illustration and accompanying documentation are consistent with design</li></ul> |
| 3 Finalise drawing for presentation | <ul style="list-style-type: none"><li>3.1 Select drawing presentation and production technique to enhance impact of jewellery or object design features and to appeal to the intended audience</li><li>3.2 Use/store/file/copy/issue working and reference drawings/illustrations in accordance with standard operating procedures</li><li>3.3 Prepare supporting information to accompany drawing, as required</li></ul>  |

## Required Skills and Knowledge

Required knowledge includes:

- common documentation, storage and retrieval
- isometric and orthographic drawing perspectives
- drawing equipment and applications, storage and maintenance
- drawing methods, protocols and symbols used in technical drawings for jewellery

manufacture

- rendering applications and techniques and tools for the creation of illustration effects
- jewellery and object design features and decorative finishes
- properties of jewellery metals used in practical manufacturing applications
- options available for drawing presentation

Required skills include:

- identifying and collecting data necessary to produce the illustration
- selecting equipment appropriate to the illustrating method and requirements
- using colour, contour, shadow/highlight techniques for emphasis to display jewellery design concept
- interpreting and clarifying illustration requirements
- drawing and rendering
- modifying drawings
- using workplace technology, including calculators, measuring and recording devices, and computing equipment

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of drawing techniques to demonstrate features of jewellery or object construction and prepare drawing for presentation according to the audience needs.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• use drawings to demonstrate the technical and visual features of jewellery or object design which will enable construction according to design requirements</li> <li>• prepare and present drawings to appeal to the specific needs of the intended audience.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning</li> </ul>

	and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Design features</b>	<p>Design features may include:</p> <ul style="list-style-type: none"> <li>materials</li> <li>dimensions</li> <li>colour</li> <li>texture</li> <li>scale</li> </ul>
<b>Appropriate equipment</b>	<p>Appropriate equipment may include:</p> <ul style="list-style-type: none"> <li>compass</li> <li>set square</li> <li>ruler</li> <li>range of graphite/colour pencils</li> <li>cartridge paper</li> </ul>

	<ul style="list-style-type: none"> <li>• pencils</li> <li>• ink (brush, pen and wash)</li> <li>• charcoal (natural and compressed)</li> <li>• conte</li> <li>• crayons</li> <li>• gouache</li> <li>• coloured pencils</li> <li>• felt tip markers</li> <li>• paper (a range of weights, textures and colours)</li> <li>• collage</li> <li>• paints</li> </ul>
<b>Accompanying documentation</b>	<p>Accompanying documentation may include:</p> <ul style="list-style-type: none"> <li>• specific design information</li> <li>• recommendations</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• client specifications</li> <li>• operational procedures</li> </ul>
<b>Drawing presentation and production techniques</b>	<p>Drawing presentation and production techniques may include:</p> <ul style="list-style-type: none"> <li>• type and grade of paper</li> <li>• printing</li> <li>• electronic and digital format</li> </ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

# **MEM19032A Design and implement mechanisms in jewellery items**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design and manufacture a range of common jewellery mechanisms. It includes development of design specifications and application of required fabrication techniques.

## **Application of the Unit**

This unit applies to enterprises where one-off, single and multi-component jewellery/3D objects are produced.

Applications of this unit include manufacturing mechanisms for brooches, either existing or new.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Not applicable.

## **Elements and Performance Criteria**

- |                       |  |
|-----------------------|--|
| 1 Determine mechanism | 1.1 Establish design requirements for mechanism from source documentation, items/samples and appropriate persons, as |
|-----------------------|--|

design requirements	required
	1.2 Identify factors and conditions affecting the design and conduct further research/design development, as required
	1.3 Select components and materials to meet design requirements
	1.4 Determine various options and select the most appropriate option to suit client requirements
2 Design mechanism	2.1 Determine specifications for manufacturing the mechanism
	2.2 Produce illustrations and/or renderings, if necessary
	2.3 Confirm final design with appropriate persons, if required
	2.4 Complete documentation of mechanism design and production specifications
3 Manufacture mechanism	3.1 Establish and adhere to occupational health and safety (OHS) and environmental requirements for carrying out work
	3.2 Plan steps/stages for manufacture of the mechanism
	3.3 Select and use tools and equipment in accordance with safe working practices
	3.4 Produce components using appropriate fabrication techniques
	3.5 Minimise waste and ensure environmental requirements are adhered to in work practice
	3.6 Ensure components conform to design specifications and are produced to correct tolerances
	3.7 Ensure all moving parts operate in a smooth, straight manner without jamming or excess play

## Required Skills and Knowledge

Required knowledge includes:

- types and applications of mechanisms
- components of mechanisms

- materials and factors affecting selection of materials
- techniques for manufacturing a range of pins, joints and catches
- tools and equipment used for manufacturing mechanisms
- OHS and environmental requirements
- safety equipment and safe working practices

Required skills include:

- communicating effectively
- selecting components and materials
- producing designs
- planning steps/stages of manufacture
- using tools and equipment
- fabricating mechanism components to specification

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to design and implement mechanisms in jewellery.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• determine mechanism requirements and develop design and production specifications</li> <li>• manufacture mechanisms according to specifications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering</li> </ul>



	<p>Training Package.</p> <ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislative and regulatory requirements</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> </ul>
<b>Mechanisms</b>	<p>Mechanisms may include:</p> <ul style="list-style-type: none"> <li>• brooch pins</li> <li>• brooch joints</li> <li>• brooch catches</li> </ul>
<b>Factors and conditions</b>	<p>Factors and conditions may include:</p> <ul style="list-style-type: none"> <li>• item design and type</li> <li>• compatibility with existing materials</li> <li>• functionality/practicality/aesthetics</li> <li>• available resources</li> <li>• client request</li> </ul>

	<ul style="list-style-type: none"> <li>time</li> <li>cost</li> </ul>
<b>Appropriate persons</b>	<p>Appropriate persons may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>manager</li> <li>trainer</li> <li>mentor</li> <li>teacher</li> <li>team member</li> <li>customer</li> </ul>
<b>Tools and equipment</b>	<p>Tools and equipment may include:</p> <ul style="list-style-type: none"> <li>drawing/illustrating equipment and media</li> <li>draw bench and plates</li> <li>soldering torch</li> <li>heating equipment</li> <li>pickling equipment</li> <li>flexible drive with drill bits</li> <li>rolling mills</li> <li>measuring and marking out equipment</li> <li>bench files</li> <li>tapered reamers</li> <li>polishing equipment</li> <li>hand tools</li> <li>consumables</li> <li>protective clothing and equipment</li> </ul>
<b>Production techniques and processes</b>	<p>Production techniques and processes may include advanced techniques of:</p> <ul style="list-style-type: none"> <li>cutting, folding, bending, curving, dapping, drawing, rolling, doming, annealing, melting, granulation, casting, pressing, stamping and laser cutting</li> <li>soldering, riveting and/or fitting</li> </ul> <p>Objects may require a combination of advanced techniques, materials and processes</p>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>liquid waste</li> <li>solid waste</li> <li>gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>excessive energy and water use</li> </ul>

	<ul style="list-style-type: none"><li>• excessive noise</li></ul>
<b>Components</b>	<p>Components may include:</p> <ul style="list-style-type: none"><li>• pins (bent end for rivet and leg for spring, soldered pin dot, soldered chenier rivet carrier, and double pin with chenier carrier)</li><li>• joints (bent up U joint and chenier joint)</li><li>• catches (figure 8, and other simple catches to suit joints and pins)</li></ul>
<b>Fabrication techniques</b>	<p>Fabrication techniques may include:</p> <ul style="list-style-type: none"><li>• drawing wire</li><li>• rolling</li><li>• bending</li><li>• drilling</li><li>• cutting</li><li>• hardening</li><li>• filing</li><li>• soldering</li><li>• reaming</li><li>• emerying</li><li>• polishing</li></ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## MEM19033A Create silversmithing objects

### Modification History

Not applicable.

### Unit Descriptor

This unit of competency covers the skills and knowledge required to design and create objects applying a range of silversmithing techniques. It includes assessing the application of the design brief in the final outcome.

### Application of the Unit

This unit applies to enterprises where functional tableware, flatware or large sculptural forms are produced.

**Band A**

**Unit Weight 4**

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Not applicable.

### Elements and Performance Criteria

- |  |  |
|--|--|
| 1 Design and develop a concept from a design brief | 1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area |
|--|--|

- 1.2 Determine requirements from the design brief, research and discussions with appropriate personnel, if required
- 1.3 Evaluate relevant research information, references and resources to the design process are evaluated
- 1.4 Record concept development through a range of drawings, notations and design options
- 1.5 Prepare production plans for selected design solutions and refine design, as appropriate
- 1.6 Produce a model or maquette of the selected design
- 1.7 Determine and obtain resources and equipment to undertake the task
- 2 Produce objects using silversmithing techniques
  - 2.1 Implement OHS requirements for carrying out the work
  - 2.2 Determine appropriate silversmithing techniques and equipment through testing and experimenting, if required
  - 2.3 Select and apply silversmithing techniques and processes to produce objects
  - 2.4 Apply relevant surface finishing techniques to objects
  - 2.5 Consult appropriate personnel to ensure that work is coordinated effectively with others, if required
  - 2.6 Make decisions on dealing with unexpected situations based on discussions with appropriate personnel
- 3 Evaluate object for meeting the design brief
  - 3.1 Implement OHS requirements for finishing the work
  - 3.2 Test object for function against the design brief, if required
  - 3.3 Evaluate and document design processes
  - 3.4 Clean up and maintain production environment
  - 3.5 Apply appropriate control measures to hazardous substances according to environmental requirements

## Required Skills and Knowledge

Required knowledge includes:

- concept development techniques
- purpose, function and maintenance of silversmithing equipment
- techniques/manufacturing methods for silversmithing production
- soldering techniques for silversmithing
- binding and locating techniques

Required skills include:

- researching information
- sketching and interpreting drawings
- generating ideas and concepts
- working with a wide range of materials and techniques
- using relevant tools and equipment for producing objects
- preparing and maintaining silversmithing tools and equipment (e.g. hammers, stakes, files and vices)
- working effectively with others
- communicating effectively

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply silversmithing techniques to the design and creation of objects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate the creation and production of silversmithing objects on more than one occasion and in different contexts. This includes: <ul style="list-style-type: none"> <li>• development of a sketchbook of drawings and notations that record: <ul style="list-style-type: none"> <li>• ideas and design options generated</li> <li>• concept development</li> <li>• relevant research</li> <li>• plans for production solutions</li> </ul> </li> </ul> </li> <li>• production of tests and experiments, where appropriate</li> <li>• production of 3D objects to specification.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations,</li> </ul>

	<p>including work areas, materials and equipment, and to information on workplace practices and OHS practices.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• manager</li> <li>• trainer</li> <li>• mentor</li> </ul>
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	<ul style="list-style-type: none"> <li>• teacher</li> <li>• team member</li> <li>• client</li> </ul>
<b>Silversmithing</b>	<p>Silversmithing may include:</p> <ul style="list-style-type: none"> <li>• maquette production</li> <li>• sinking</li> <li>• crimping</li> <li>• raising</li> <li>• spinning</li> <li>• planishing</li> <li>• forging</li> <li>• hinge making</li> <li>• fabricating</li> <li>• forming</li> </ul>
<b>Surface finishing techniques</b>	<p>Surface finishing techniques may include:</p> <ul style="list-style-type: none"> <li>• electroplating</li> <li>• planishing</li> <li>• patination</li> <li>• polishing</li> <li>• burnishing</li> <li>• heat treating</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> </ul>



	<ul style="list-style-type: none"><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19034A Apply chain manufacture process**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to plan, construct and solder a series of chains according to required specification.

### **Application of the Unit**

This unit applies to enterprises where jewellery is designed and/or made.

**Band A**

**Unit Weight 2**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |   |   |
|---|---|
| 1 Draw wire for chain making to size required | 1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area |
|   | 1.2 Establish item requirements and specifications from source  |

- documentation and/or appropriate personnel, as required
- 1.3 Establish and organise stages, materials and tools/equipment for the fabrication process
  - 1.4 Calculate required material
  - 1.5 Cut materials and draw wire to the required size
  - 1.6 Anneal materials, as necessary, to relieve stress/work hardening
  - 1.7 Draw materials to specified tolerance using appropriate equipment
  - 1.8 Obtain and check resources and equipment for the task are fit for purpose
- 2 Fabricate jewellery chains
- 2.1 Follow OHS requirements for carrying out the work
  - 2.2 Produce spit jig suitable for specified chain
  - 2.3 Produce links to the correct size and specification
  - 2.4 Solder links free from pit holes and flooding
  - 2.5 Construct chain links accurately and sequentially
  - 2.6 Conduct quality assurance during construction to maintain link consistency and meet requirements
- 3 Finish jewellery chains
- 3.1 Follow OHS requirements for completing the work
  - 3.2 Polish and finish chains to a blemish-free high lustre
  - 3.3 Clean up and maintain production environment, including polishing machines/tumblers, according to enterprise procedures

## Required Skills and Knowledge

Required knowledge includes:

- uses of wire and chain
- safety requirements for drawing wire
- use of rolling equipment and techniques for rolling
- calculations and measurements
- procedures to anneal material and reasons for stress relieving metal

- equipment and techniques for wire drawing
- use of cleaning solution and safe practices with chemicals
- procedure to make a split jig
- techniques for coiling and cutting link wire
- procedures to fit and solder chain links
- safe use of polishing lathe and polishing tumbler
- selection and use of buffs and compounds
- selection, use and maintenance of steel polishing shot

Required skills include:

- calculating required material size
- cutting materials
- rolling materials to size and thickness
- annealing materials
- drawing materials to size
- soldering materials/items
- cleaning materials/items
- filing and finishing items
- polishing jewellery chains

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply soldering techniques to produce chains according to specification.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate applying chain manufacturing process on more than one occasion and in different contexts. This includes: <ul style="list-style-type: none"> <li>• draw wire materials to size required</li> <li>• produce jewellery items/chains from wire</li> <li>• fabricate finished jewellery chains to specification.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS</li> </ul>

	<p>practices.</p> <ul style="list-style-type: none"> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>manager</li> <li>trainer</li> <li>mentor</li> <li>teacher</li> <li>team member</li> </ul>
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	<ul style="list-style-type: none"> <li>• client</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• draw bench</li> <li>• jewellery bench</li> <li>• soldering torch</li> <li>• adjustable chair</li> <li>• pickle bath and heater</li> <li>• propane-oxy heating equipment</li> <li>• flexible drive and drill bits</li> <li>• spit jigs</li> <li>• hand tools</li> <li>• measuring and marking out equipment</li> <li>• abrasives, lubricants and compounds</li> <li>• round square and fancy shaped drawplates</li> <li>• stock gauge rod and wire for chain links</li> <li>• polishing lathe with extraction, buffs, brushes and compounds</li> <li>• tumbler with stainless/steel shot</li> <li>• protective clothing and equipment</li> </ul>

<b>Finished/polished</b>	Finished/polished may include: <ul style="list-style-type: none"><li>• finishing by files and emery</li><li>• tumbling with appropriate shot</li><li>• polishing on a polishing lathe using appropriate brushes and compounds</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19035A Plan and apply casting techniques for jewellery and object designs**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to plan and apply casting techniques for constructing jewellery and object designs. It includes use of wax models and moulds and application of metal casting skills.

### **Application of the Unit**

This unit applies to jewellery and object designers who make items according to design specifications, where casting and associated techniques are required for the production of jewellery and 3D objects.

**Band A**

**Unit Weight 4**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.



## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Examine design brief and prepare for work    | <ul style="list-style-type: none"><li>1.1 Review design brief and all documentation to confirm specifications</li><li>1.2 Determine type of casting techniques and resources appropriate for design</li><li>1.3 Develop work plan for production</li><li>1.4 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area</li></ul>  |
| 2 Produce wax models                           | <ul style="list-style-type: none"><li>2.1 Determine process requirements for production of wax model</li><li>2.2 Identify required equipment and prepare for use</li><li>2.3 Cut materials to required dimensions using appropriate tools</li><li>2.4 Sculpt wax model to specifications and minimise imperfections</li><li>2.5 Apply surface finishes as required</li></ul>  |
| 3 Produce moulds                               | <ul style="list-style-type: none"><li>3.1 Select appropriate moulding material for style of master, and prepare, pack, dry and burn out correctly</li><li>3.2 Carry out wax injection of moulds using appropriate tools, materials and processes, if required</li><li>3.3 Vulcanise/cure rubber correctly, if appropriate</li><li>3.4 Release master pattern correctly using appropriate tools</li></ul>  |
| 4 Cast metals for jewellery and object designs | <ul style="list-style-type: none"><li>4.1 Establish casting requirements from source documentation and/or appropriate personnel, as required</li><li>4.2 Select metals and alloys in appropriate proportions and weigh correctly and in correct wax-to-metal ratios</li><li>4.3 Prepare casting equipment according to established enterprise procedures</li><li>4.4 Carry out pre-heating/glazing, if applicable</li><li>4.5 Cast jewellery item or object using correct procedures with respect to maintaining temperature, applying protective coating, if required, and handling of hot molten metal</li><li>4.6 Allow for adequate solidification time</li></ul> |

#### 4.7 Clean up work area and equipment and dispose of waste according to environmental requirements

### Required Skills and Knowledge

Required knowledge includes:

- design casting process
- properties of metals and alloys
- making the master model
- moulding
- making the wax pattern
- investment
- burn out
- melting
- casting
- removing investment
- cutting
- finishing
- workshop procedures
- casting defects
- minimising casting defects

Required skills include:

- selecting appropriate quality materials for the production of wax model
- producing wax models to given specifications and minimising imperfections
- performing wax injection of mould, where applicable
- correctly vulcanising and curing rubber moulds where applicable
- using molten metal safely
- casting jewellery and objects using different techniques and materials
- applying appropriate finishing techniques to cast object

### Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply casting techniques required in the production of jewellery and object designs.
<b>Critical aspects for assessment and evidence required to demonstrate</b>	Assessors must be satisfied that the candidate can competently and consistently:

<b>competency in this unit</b>	<ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate the application of jewellery casting techniques on more than one occasion and in different contexts. This includes: <ul style="list-style-type: none"> <li>• producing wax models</li> <li>• performing investment procedures</li> <li>• producing moulds for lost wax, cuttlefish or sand casting</li> <li>• casting jewellery objects.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for</b>	Assessment processes and techniques must be culturally

<b>assessment</b>	appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• foreman</li> <li>• manager</li> <li>• trainer</li> <li>• mentor</li> <li>• teacher</li> <li>• team member</li> <li>• client</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>
<b>Surface finishes</b>	<p>Surface finishes may include:</p> <ul style="list-style-type: none"> <li>• fine emery</li> <li>• shellite</li> </ul>

<b>Casting methods</b>	<p>Casting methods may include:</p> <ul style="list-style-type: none"> <li>• cuttlefish</li> <li>• centrifugal</li> <li>• vacuum casting</li> <li>• delft clay</li> </ul>
<b>Wax injection</b>	<p>Wax injection may include:</p> <ul style="list-style-type: none"> <li>• primarily to organic/synthetic wax injection, but may include resin and plastic materials injected under pressure for investment and burn out aspects within 'lost wax' casting procedures</li> </ul>
<b>Casting</b>	<p>Casting may include:</p> <ul style="list-style-type: none"> <li>• primarily by the 'lost wax' method of investment casting, but may include cuttlebone and sand processes as extensions</li> </ul>
<b>Metals and alloys</b>	<p>Metals and alloys may include:</p> <ul style="list-style-type: none"> <li>• gold</li> <li>• platinum</li> <li>• palladium</li> <li>• silver</li> <li>• copper</li> <li>• pewter and their alloys</li> </ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

# **MEM19036A Use specialised techniques to produce jewellery and objects**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply a range of specialised or complex techniques to produce jewellery and/or object designs.

## **Application of the Unit**

This unit applies to enterprises where jewellery is designed and made according to design specifications. Metal working skills described by this unit are not performed to trade level outcomes, rather to allow the production of one-off custom jewellery and object designs. Application of this unit requires use of a range of hand and power tools used in the construction of jewellery and objects.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Not applicable.

## **Elements and Performance Criteria**

- |   |   |
|---|---|
| 1 Prepare for applying specialised production | 1.1 Establish work area and prepare for work  |
|   | 1.2 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and |

techniques	for the work area
	<ol style="list-style-type: none"><li>1.3 Analyse design specifications and related information for jewellery or object and determine production requirements from documentation and discussion with appropriate persons</li><li>1.4 Develop a production plan, identifying the multiple steps and operations for manufacture, required components, soldering plan, fitting of pieces, required materials, tools, equipment and processes/techniques</li><li>1.5 Identify potential manufacturing difficulties for jewellery or object and develop solutions based on understanding of materials, their limitations and workability, as well as knowledge of processes and techniques</li><li>1.6 Select and prepare materials and equipment required</li></ol>
2 Apply specialised techniques	<ol style="list-style-type: none"><li>2.1 Implement OHS and environmental requirements</li><li>2.2 Determine and apply calculations and formulae, as necessary, to determine material quantities, dimensions and sizing</li><li>2.3 Produce jewellery or object features using specialised techniques</li><li>2.4 Identify faults and problems and take corrective action</li><li>2.5 Confirm work meets design specifications</li><li>2.6 Finish work according to requirements of technique used</li></ol>
3 Present and evaluate finished piece	<ol style="list-style-type: none"><li>3.1 Confirm finished piece meets design specifications</li><li>3.2 Prepare piece for presentation</li><li>3.3 Evaluate result and identify and make any final improvements</li></ol>

## Required Skills and Knowledge

Required knowledge includes:

- range and uses of specialised techniques
- calculations and measurements
- reasons for selecting particular metals, construction methods, manufacturing and finishing techniques
- tools and equipment matched to processes
- planning and process stages

- working properties of precious and non-precious metals and/or other materials
- fine detail manufacturing processes
- knowledge of workplace hazards and emergency procedures
- various components of jewellery items
- appropriate measuring devices and recording methods
- procedures for final treatment
- safe handling and storage of items
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures

Required skills include:

- calculating required material size
- using tools and equipment for jewellery and object construction
- interpreting design specifications and following instructions
- interpreting drawings
- measuring
- selecting appropriate materials and manufacturing techniques
- applying appropriate production and finishing procedures
- identifying alternative metals/materials
- meeting design specifications
- cleaning materials/items
- filing and finishing items
- communicating design and construction information

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a minimum of four (4) specialised techniques to produce jewellery and object designs according to specification.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement OHS workplace procedures and practices, including the use of risk control measures</li><li>• apply a minimum of four specialised techniques to produce jewellery and object designs on more than one occasion and in different contexts. This includes:<ul style="list-style-type: none"><li>• determining manufacturing requirements</li><li>• developing a production plan</li><li>• using a combination of techniques, materials and</li></ul></li></ul>



	<p>processes</p> <ul style="list-style-type: none"> <li>finishing and inspecting work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li></ul>
<b>Specialised techniques</b>	<p>Specialised techniques may include:</p> <ul style="list-style-type: none"><li>• repousse or chasing</li><li>• forging</li><li>• electro forming</li><li>• die forming</li><li>• etching</li><li>• granulation</li><li>• hydraulic pressing</li><li>• patination</li><li>• inlay</li><li>• anodising</li><li>• cuttlefish casting</li><li>• sand casting</li><li>• water casting</li><li>• box construction</li><li>• lamination</li><li>• tap and die</li></ul>

	<ul style="list-style-type: none"><li>• photoetching</li><li>• mokume</li><li>• kumboo</li><li>• hollow forming</li><li>• enamelling</li></ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"><li>• draw bench</li><li>• round, square and fancy draw plates</li><li>• various holding and securing devices</li><li>• pliers</li><li>• burrs</li><li>• scaupers</li><li>• burnishers</li><li>• emery and beadars</li><li>• soldering torch</li><li>• jewellery bench</li><li>• adjustable chair</li><li>• pickle bath and heater</li><li>• propane-oxy heating equipment</li><li>• flexible drive and drill bits</li><li>• spit jigs</li><li>• hand tools</li><li>• measuring and marking out equipment</li><li>• abrasives, lubricants and compounds</li><li>• stock gauge rod, wire for chain links</li><li>• polishing lathe with extraction, buffs, brushes and compounds</li><li>• tumbler with stainless/steel shot</li><li>• protective clothing and equipment</li></ul>
<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"><li>• gold</li><li>• platinum</li><li>• palladium</li><li>• silver</li><li>• copper</li><li>• pewter and their alloys</li><li>• stones and gems</li><li>• catches, chains and other jewellery components</li><li>• finishing materials</li></ul>

## **Unit Sector(s)**

Jewellery and horological

## **Custom Content Section**

Not applicable.

## **MEM19037A Plan and implement chenier fabrication process**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to fabricate chenier items and basic hinges.

### **Application of the Unit**

This unit applies to enterprises where jewellery and objects are designed, made or repaired.

**Band A**

**Unit Weight 2**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |                             |   |
|-----------------------------|---|
| 1 Plan and prepare for work | 1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area |
|                             | 1.2 Establish resource requirements and specifications from source  |

- documentation and/or appropriate persons, as required
- 1.3 Establish, plan and organise stages, materials and tools/equipment for the fabrication process
  - 1.4 Calculate required material
  - 2 Draw chenier materials to size
    - 2.1 Cut materials, establishing wall thickness and diameter, swage or form, if applicable, to required size
    - 2.2 Anneal materials to relieve stress
    - 2.3 Draw materials to specified tolerance using appropriate equipment
    - 2.4 Carry out finishing processes, such as soldering, to specification
  - 3 Produce items from cheniers
    - 3.1 Follow OHS requirements for carrying out the work
    - 3.2 Solder seams free from pin holes, inclusions and excess flooding
    - 3.3 Ensure cheniers have a smooth, blemish-free surface
    - 3.4 Conduct quality assurance during construction to maintain finish consistency and ensure items are produced to all specified dimensions
  - 4 Fabricate hinges
    - 4.1 Follow OHS requirements for carrying out the work
    - 4.2 Produce knuckles and bearer wires or sheets
    - 4.3 Ensure items are gapped to size and specification
    - 4.4 Ensure knuckles are cut, filed and placed according to item requirement
    - 4.5 Ensure solder is flushed and drawn under knuckles
    - 4.6 Ensure pin fits comfortably through knuckles of adjoining sides

## Required Skills and Knowledge

Required knowledge includes:

- uses of cheniers
- safety requirements for drawing of cheniers
- use of rolling equipment and techniques for rolling
- calculations and measurements

- procedure to anneal material and reasons why this is needed
- equipment and techniques for drawing chenier
- procedure to swage, draw and solder chenier
- use of pickling solution and safe use of solution
- procedure to fit and solder knuckles
- safe use of polishing machine
- selection and use of mops, wheels and compounds

Required skills include:

- calculating required material size
- cutting materials
- rolling materials to size and thickness
- annealing materials
- drawing materials to size
- swaging or forming materials
- soldering materials/items
- pickling, filing and finishing items
- polishing jewellery items

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply techniques to fabricate chenier and basic hinge according to specification.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• draw chenier materials to size</li> <li>• produce items using chenier</li> <li>• fabricate sample cheniers and hinges to specification.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> </ul>

	<ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>manager</li> <li>trainer</li> <li>mentor</li> <li>teacher</li> <li>team member</li> <li>client</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>legislation</li> <li>protective equipment</li> </ul>



	<ul style="list-style-type: none"> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>
<b>Material</b>	<p>Material may include:</p> <ul style="list-style-type: none"> <li>• various thickness sheets</li> <li>• silver, gilding, nickel silverhard and medium solder</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• jewellery bench</li> <li>• soldering torch and equipment</li> <li>• adjustable chair</li> <li>• pickle bath and heater</li> <li>• flexible drive and drill bits</li> <li>• swage blocks</li> <li>• hand tools</li> <li>• measuring and marking out equipment</li> <li>• abrasives</li> <li>• draw bench and various drawplates</li> <li>• polishing motor with extraction, mops, brushes and various polishing compounds</li> <li>• protective clothing and equipment</li> </ul>
<b>Finished/polished</b>	<p>Finished/polished may include:</p> <ul style="list-style-type: none"> <li>• finishing by files and emery</li> <li>• polishing on a polishing motor using appropriate mops and compounds</li> </ul>

## **Unit Sector(s)**

Jewellery and horological

## **Custom Content Section**

Not applicable.

## **MEM19038A Apply traditional techniques to jewellery and 3D object production**

### **Modification History**

Release 2 - Band A and 4 points allocated to unit for use in Certificate IV

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to produce jewellery items using traditional techniques. It includes conducting research to assess the suitability of traditional techniques for achieving desired outcomes and identifying and addressing problems which may arise in reproduction.

### **Application of the Unit**

This unit is applied to jewellery production using traditional techniques and incorporating them into contemporary jewellery manufacture.

Band A

Unit Weight 4

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |   |  |
|---|--|
| 1 Identify item requirements employing traditional techniques | 1.1 Identify and research features and applications of a given traditional jewellery or object production technique  |
|   | 1.2 Establish requirements for applying a given technique to a specified item from source documentation and/or appropriate persons   |
|   | 1.3 Assess the suitability of the required technique to specific jewellery or object item, identify potential problems and difficulties and consider alternatives in consultation with appropriate persons |
| 2 Select and source materials and equipment                   | 2.1 Identify and source materials appropriate to the production of selected technique  |
|   | 2.2 Obtain and/or produce tools and equipment appropriate to the technique   |
| 3 Apply traditional techniques to produce item                | 3.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area   |
|   | 3.2 Identify and plan stages, materials and tools/equipment involved in producing the technique  |
|   | 3.3 Identify and use other information and conditions relevant to successfully applying the technique  |
|   | 3.4 Reproduce traditional jewellery or object production technique according to industry standards and client expectations   |

## Required Skills and Knowledge

Required knowledge includes:

- features, applications and traditional development of traditional techniques
- problems and difficulties in applying techniques
- guidelines/principles/conditions for successful application of given technique
- stages and steps involved in producing given technique
- tools and equipment for applying given technique

Required skills include:

- researching particular techniques

- questioning and clarifying information
- planning the steps in a process
- operating/using relevant hand tools and equipment
- applying a given traditional technique

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to replicate traditional techniques in the production of jewellery and 3D objects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• identify features and applications of a given traditional technique</li> <li>• identify conditions for successful application of given technique</li> <li>• apply a given technique to selected items.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning</li> </ul>

	<p>knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• manager</li> <li>• trainer</li> <li>• mentor</li> <li>• teacher</li> <li>• team member</li> <li>• client</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>

<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>
<b>Traditional techniques</b>	Traditional techniques may include: <ul style="list-style-type: none"> <li>• filigree</li> <li>• repousse</li> <li>• chasing</li> <li>• granulation</li> <li>• mokume gane</li> <li>• pamor</li> <li>• niello</li> </ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"> <li>• material for given technique</li> <li>• reference publications</li> </ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"> <li>• hand and power tools</li> <li>• machines</li> </ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19039A Plan, conduct and supervise a jewellery and object exhibition**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to coordinate jewellery exhibitions from the conceptual stage through to the design, planning, implementation and evaluation stages.

### **Application of the Unit**

This unit applies to private and public exhibitions of 3D objects from one of more contributors.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |  |   |
|--|---|
| 1 Identify exhibition's or program's purpose, aims and rationale | 1.1 Clarify and confirm the exhibition's aims, objectives and purpose and assess feasibility within existing technical and spatial constraints, resource estimates and timeframes |
|  | 1.2 Engage all relevant personnel and stakeholders and gain input and consensus on the overall message, subject   |



- matter, style and intended target audience's experience
- 1.3 Confirm that the agreed purpose, aims and objectives are philosophically and culturally acceptable and complementary to other organisational objectives
  - 1.4 Determine range of jewellery or object items to be included and selection criteria
- 2 Confirm type of exhibition or program and develop plan
- 2.1 Determine suitable options for jewellery or object exhibition or program in consultation with relevant personnel
  - 2.2 Assess options against existing constraints and financial resources and select most appropriate format
  - 2.3 Present selection and rationale to stakeholders to gain approval
  - 2.4 Develop plans detailing the nature and scope of the program, its intended outcome, resources required and timeframe
  - 2.5 Identify opportunities for related activities, public relations and advertising
  - 2.6 Detail the operational requirements for the exhibition or program based on consultation with relevant parties
  - 2.7 Identify and document funds and other resources required
  - 2.8 Identify and document safety hazards and determine risk control measures to be implemented
- 3 Prepare to hold the exhibition or program
- 3.1 Establish and confirm the financial and physical resources, appropriate personnel and organisational structures required
  - 3.2 Identify staff responsibilities and conduct briefings with all relevant parties
  - 3.3 Determine and source jewellery or objects to be included and ensure compatibility with exhibition or program objectives
  - 3.4 Evaluate the contribution of jewellery or object pieces to the overall impact and objectives of exhibition or program
  - 3.5 Establish and action promotional and public relations activities and other ways of reaching the audience

- 3.6 Confirm evaluation mechanisms through consultation and negotiation
- 3.7 Ensure occupational health and safety (OHS) requirements and risk control measures and procedures are established
- 3.8 Assess the environmental implications of the exhibition or program and determine ways to minimise impacts
- 4 Manage implementation
  - 4.1 Follow agreed plans and procedures and coordinate the program or exhibition as intended
  - 4.2 Ensure transportation and placement of jewellery or objects is conducted to ensure items are not damaged
  - 4.3 Deploy and coordinate personnel as required
  - 4.4 Make variations, adjustments and changes to plan, as required, without compromising the activity
  - 4.5 Obtain and monitor audience feedback and other performance information
  - 4.6 Monitor safety and environmental impacts and make adjustments, as required, to improve outcomes
- 5 Evaluate effectiveness of exhibition
  - 5.1 Determine evaluation questions, sources of evaluation data and methods of collecting data
  - 5.2 Develop and implement suitable and valid methods for collecting data
  - 5.3 Collate, analyse and report evaluation data
  - 5.4 Document exhibition/program outcomes and identify benefits and areas for improvement
  - 5.5 Present findings to relevant stakeholders

## Required Skills and Knowledge

Required knowledge includes:

- specialised knowledge of subject areas
- the institution's policies and priorities for exhibitions and public programs
- legal, ethical and financial requirements for exhibitions and public programs

- insurance and indemnity requirements
- cultural protocols and applying cross-cultural sensitivity and effective communication techniques to all communications
- Indigenous culture and issues
- intellectual and copyright issues
- safe work and manual handling procedures
- the institution's users and their needs
- sources of expert advice
- security and protection of the collection
- conservation methods and principles
- evaluation techniques
- effective customer service
- proposal development
- exhibition presentation techniques
- audience development

Required skills include:

- applying lateral thinking skills and solving difficult or unusual problems
- applying a wide range of highly specialised technical, creative or conceptual skills
- managing functions of others
- managing projects
- planning projects, funding and management
- developing and delivery programs
- listening, questioning and clarifying
- writing business letters, proposals, project plans and reports
- reading detailed planning documents
- speaking clearly, concisely and in a friendly manner
- planning, implementing, monitoring and evaluating projects
- working collaboratively in a team
- leading a team
- networking within the community
- managing human, financial and technical resources
- preparing budgets and resource estimates
- planning marketing

## Evidence Guide

Overview of assessment	
	A person who demonstrates competency in this unit must be able to plan and implement a jewellery and object exhibition according to organisational objectives and requirements.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• develop a plan for a jewellery and object exhibition which details all aspects of the activity, including use of resources, marketing and operational plans</li> <li>• coordinate the implementation of a jewellery and object exhibition</li> <li>• assess the impacts of the exhibition.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for</b>	Assessment processes and techniques must be culturally

<b>assessment</b>	appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

<b>OHS requirements</b>	OHS requirements may include: <ul style="list-style-type: none"><li>• legislative and regulatory requirements</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li></ul>
<b>Constraints</b>	Constraints may include: <ul style="list-style-type: none"><li>• physical or environmental</li><li>• financial</li><li>• human</li><li>• ethical</li><li>• cultural</li><li>• time</li></ul>
<b>Operational requirements</b>	Operational requirements may include: <ul style="list-style-type: none"><li>• physical access</li><li>• security</li><li>• audience awareness</li><li>• publications</li><li>• catering</li><li>• Commercial activities</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• venue</li><li>• display items</li><li>• display accessories</li><li>• display media, information and images</li><li>• lighting</li><li>• catering</li><li>• administrative and financial resources</li><li>• personnel</li><li>• insurance and indemnification requirements</li><li>• financial requirements</li></ul>
<b>Environmental requirements</b>	Environmental requirements may relate to:

	<ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fumes, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"><li>• supervisors</li><li>• managers</li><li>• trainers</li><li>• mentors</li><li>• teachers</li><li>• team members</li><li>• subject matter experts</li><li>• curators</li><li>• conservators</li><li>• educators</li><li>• audiovisual specialists</li><li>• information technology specialists</li><li>• editors</li><li>• designers</li><li>• engineers</li><li>• architects</li><li>• historians</li><li>• draftspeople</li><li>• suppliers and contractors</li></ul>
<b>Sources of evaluation data</b>	<p>Sources of evaluation data may include:</p> <ul style="list-style-type: none"><li>• attendance records</li><li>• visitor surveys, interviews, focus groups and advisory groups/committees</li><li>• booking records</li><li>• staff observations and knowledge</li><li>• media coverage</li></ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19040A Create and manufacture jewellery or object design prototypes for the mass market**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply creative and technical processes to develop jewellery or object designs for the mass market. It includes the development and testing of a prototype and evaluation of product viability.

### **Application of the Unit**

This unit applies to designers who are responsible for creating and manufacturing jewellery or object design prototypes.

The unit applies to the analysis of commercial market opportunities and development of a design and production brief leading to development of one-off, limited edition, series and mass produced jewellery or objects.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |                            |  |
|----------------------------|--|
| 1 Define and evaluate mass | 1.1 Define difference between one-off, limited edition, series and mass produced products and the benefits and |
|----------------------------|--|



market opportunities	opportunities for jewellery and object designs
	1.2 Identify commercial and design objectives of the client or workplace
	1.3 Analyse commercial jewellery and object markets and current and emerging product trends and technologies
	1.4 Conduct market research to inform development of design directions
2 Determine suitable jewellery or object manufacturing processes	2.1 Identify in-house manufacturing capabilities available for producing designs and determine the strengths and weaknesses of this form of jewellery or object production
	2.2 Identify external manufacturing resources and suppliers available for producing designs and determine their strengths and weaknesses
	2.3 Estimate costing impacts of internal and external production suppliers on the overall design costs
3 Develop jewellery or object design concepts	3.1 Apply information from market and production analysis to development of commercial product ideas
	3.2 Consult with appropriate personnel to analyse and refine ideas and develop a design brief
	3.3 Test design brief with appropriate personnel and confirm specifications for product development
	3.4 Develop jewellery or object design concepts and solutions in accordance with design brief and determine required manufacturing processes
4 Specify design production requirements	4.1 Document design and production specifications
	4.2 Identify target audience, market position and objectives for jewellery or object
	4.3 Prepare costing estimates
	4.4 Develop and present product proposal to test viability and confirm design specifications
	4.5 Develop work plan for design production
5 Prepare design prototype	5.1 Plan for the production of jewellery or object design prototype

- 5.2 Prepare materials and equipment for development
- 5.3 Produce jewellery or object design prototype in accordance with design specifications
- 5.4 Evaluate production and design results against design brief, costings, marketing objectives and specifications
- 5.5 Make adjustments to concept, specifications or production processes to improve result
- 5.6 Finalise design and production specifications
- 6 Document and present design solution
  - 6.1 Prepare documentation and drawings of design solution to clearly demonstrate jewellery or object features and specifications
  - 6.2 Present design solution prototype to relevant personnel and seek feedback
  - 6.3 Evaluate design process and outcomes to determine success in meeting design objectives

## Required Skills and Knowledge

Required knowledge includes:

- supply chain management
- outsourcing arrangements
- cost-benefit analysis methods
- research resources and techniques for investigating design information
- elements and principles of design as they relate to design of jewellery and objects
- jewellery designs (e.g. shanks, settings styles, shoulders and decorative finishes)
- working properties of jewellery materials
- methods of production for jewellery and objects
- design resources
- brainstorming and other idea generation techniques for research/idea development
- elements and principles of design, including form, harmony and line
- design considerations
- drawing media and their functions/applications, including paper, watercolours and pastels/inks/pencils
- drawing tools and their functions/applications, including stencils and rubbers
- design documentation
- form drawing development

- options available for drawing presentation
- enhancement techniques
- types of working drawings and their uses
- the interrelation between technical and design drawings
- hazard and control measures associated with preparing jewellery designs
- safe work practices

Required skills include:

- interpreting and clarifying a design brief
- identifying and collecting information necessary to create design concepts
- drawing
- conducting market research
- identifying features and benefits of design solutions
- selecting production processes
- developing and refining ideas
- applying principles and elements of design
- reading and interpreting information on specifications, design documentation, illustrations, design drawings and other applicable source documents
- identifying purpose and needs, including design considerations, item end use, proportions and desired features, and available materials
- checking and clarifying information
- documenting and maintaining design process, features and design development notes
- producing basic form drawings that accurately reflect design concept
- using drawing and/or rendering techniques appropriately
- undertaking numerical operations, geometry and calculations within the scope of the unit
- carrying out work according to occupational health and safety (OHS) practices

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply a range of creative processes to develop and refine design concepts that meet commercial objectives.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices</li> <li>• analyse jewellery and object markets to identify commercial opportunities</li> <li>• develop a design brief and determine key parameters</li> <li>• apply creative processes to develop, refine and test design concepts</li> </ul>

	<ul style="list-style-type: none"> <li>• apply knowledge of materials and production processes to jewellery and object design</li> <li>• produce design prototypes</li> <li>• prepare and present design concepts to appeal to the specific needs of the intended audience</li> <li>• evaluate success of design in meeting design brief and commercial objectives.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>Manufacturing processes</b>	Manufacturing processes may include, but are not limited to: <ul style="list-style-type: none"><li>• centrifugal casting</li><li>• spinning</li><li>• engraving</li><li>• electroplating</li><li>• laser cutting</li><li>• die forming</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• manager</li><li>• trainer</li><li>• mentor</li><li>• teacher</li><li>• team member</li></ul>
<b>Market research</b>	Market research may include: <ul style="list-style-type: none"><li>• analysis of target market characteristics</li><li>• sample testing</li><li>• discussions with retailers and suppliers</li><li>• discussions with staff and management</li><li>• review of media portrayals</li><li>• review of jewellery or object shows</li><li>• review of current pricing strategies and price points of products</li></ul>
<b>Design documents</b>	Design documents may include: <ul style="list-style-type: none"><li>• sketches</li><li>• illustrations</li><li>• concept drawings</li><li>• working drawings</li><li>• technical data</li><li>• supporting information</li><li>• specifications</li><li>• production plans</li></ul>
<b>Costings</b>	Costings may include: <ul style="list-style-type: none"><li>• labour</li><li>• overheads</li></ul>

	<ul style="list-style-type: none"><li>• materials</li><li>• tooling</li><li>• equipment</li><li>• outsourcing</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19041A Experiment with jewellery or object designs**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply technical and design skills to trial experimental designs and techniques in jewellery or object design. It targets the creative process to inform development of design concepts.

### **Application of the Unit**

This unit applies to jewellery or object designers producing innovative concepts for custom production or exhibition. Application of this unit involves experimentation with materials and construction processes to develop design concepts, and testing of concept viability.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |   |  |
|---|--|
| 1 Conduct research into jewellery and object design | 1.1 Confirm objectives and parameters for design process   |
|   | 1.2 Access and analyse local and international information on jewellery and object design, materials and production trends |

- 1.3 Identify trends in local and international market conditions
- 1.4 Determine impact of sustainability considerations on jewellery and object design
- 1.5 Identify opportunities for jewellery or object design
- 1.6 Determine funding opportunities for design development
- 1.7 Identify occupational health and safety (OHS) considerations for design
- 2 Apply creative process to develop design concepts
  - 2.1 Examine possible future directions for jewellery and object design
  - 2.2 Scope future directions to guide concept development
  - 2.3 Use creative design tools and techniques to develop concepts for jewellery or object designs
  - 2.4 Experiment with materials to further develop design concept
  - 2.5 Experiment with jewellery or object construction techniques to further develop design concept
  - 2.6 Apply knowledge of design elements and principles to design concepts
  - 2.7 Document processes and outcomes of experimentation
  - 2.8 Select design concepts for testing
- 3 Assess design concepts
  - 3.1 Test design concepts with selected personnel, obtain feedback and integrate as appropriate
  - 3.2 Determine production processes and requirements for concepts and assess viability of design concepts
  - 3.3 Develop preliminary costings
  - 3.4 Conduct tests to assess quality of design
  - 3.5 Assess design concepts against project objectives and parameters
  - 3.6 Determine viability of jewellery or object designs in current market and assess expected response of intended audience



- 3.7 Select concept for development
- 4 Confirm and document design proposal
  - 4.1 Review and rework design concept
  - 4.2 Determine and document design specifications and production plan
  - 4.3 Produce proposal for jewellery or object design, including supporting information and documentation

## Required Skills and Knowledge

Required knowledge includes:

- range and uses of jewellery and object production techniques
- calculations and measurements
- reasons for selecting particular materials, construction methods, manufacturing and finishing techniques
- creative design tools and processes
- principles and elements of design
- planning and process stages
- working properties of precious and non-precious metals and/or other materials
- fine detail manufacturing processes
- workplace hazards and emergency procedures
- various components of jewellery items
- appropriate measuring devices and recording methods

Required skills include:

- developing designs
- production skills in order to experiment with design concepts
- selecting appropriate materials and manufacturing techniques
- identifying alternative metals/materials
- determining design specifications
- applying creative processes
- documenting design specifications
- conducting research
- assessing and testing design concepts
- communicating design and construction information
- working with others to develop designs

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to experiment with a range of materials and processes to develop and select a design concept.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• apply skill and knowledge in materials and construction processes to experiment with and develop design concepts</li> <li>• test and assess the viability of design concepts</li> <li>• use and produce design documentation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred</li> </ul>

	<p>to other circumstances.</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Objectives for design process</b>	<p>Objectives for design process may include:</p> <ul style="list-style-type: none"> <li>exhibition</li> <li>sale</li> <li>presentation or display</li> <li>creative expression</li> <li>commercial production</li> <li>custom production</li> <li>demonstrate ability or for portfolio</li> <li>develop design skills</li> <li>innovate new design concepts</li> <li>marketing or promotion</li> </ul>
<b>Parameters for design process</b>	<p>Parameters for design process may include:</p> <ul style="list-style-type: none"> <li>availability of materials and equipment</li> <li>budget</li> <li>timelines</li> <li>required criteria</li> <li>design brief</li> </ul>
<b>Market conditions</b>	<p>Market conditions may include:</p> <ul style="list-style-type: none"> <li>fashion trends</li> <li>price and availability of materials and other resources</li> <li>disposable income of target market</li> <li>purchasing preferences</li> </ul>
<b>Sustainability considerations</b>	<p>Sustainability considerations may include:</p> <ul style="list-style-type: none"> <li>impact on environment (e.g. generation of waste and by-products resulting from production or end use, and use of precious or rare materials)</li> <li>impact on greater society (e.g. health risks to those obtaining materials or providing resources, and community values with regard to design features)</li> </ul>

	<ul style="list-style-type: none"> <li>• impact on economy (e.g. contribution to financial wellbeing of community)</li> </ul>
<b>Future directions for jewellery and object designs</b>	<p>Future directions for jewellery and object design may include:</p> <ul style="list-style-type: none"> <li>• new uses and applications</li> <li>• new materials</li> <li>• new technologies and equipment</li> <li>• new markets or market conditions</li> <li>• changes to pricing, distribution or other marketing variables</li> </ul>
<b>Elements and principles of design</b>	<p>Design elements include:</p> <ul style="list-style-type: none"> <li>• colour</li> <li>• direction</li> <li>• form</li> <li>• light</li> <li>• line</li> <li>• mass</li> <li>• point</li> <li>• shape</li> <li>• size</li> <li>• space</li> <li>• texture</li> <li>• time</li> <li>• tone</li> <li>• value</li> </ul> <p>Design principles include:</p> <ul style="list-style-type: none"> <li>• balance</li> <li>• contrast</li> <li>• dominance</li> <li>• emphasis</li> <li>• harmony</li> <li>• movement</li> <li>• pattern</li> <li>• proportion</li> <li>• rhythm</li> <li>• unity</li> </ul>
<b>Creative design tools and techniques</b>	<p>Creative design tools and techniques may include use of:</p> <ul style="list-style-type: none"> <li>• colour wheels</li> <li>• collage</li> <li>• materials board</li> </ul>

	<ul style="list-style-type: none"><li>• mind mapping</li><li>• drawings (hand drawings and electronic)</li><li>• pictures, photographs and images</li><li>• discussions with others</li><li>• models</li><li>• exhibitions</li><li>• examination of jewellery and objects</li></ul>
<b>Design tests</b>	Design tests may include, but are not limited to: <ul style="list-style-type: none"><li>• market feedback</li><li>• testing strength of components and whole piece</li><li>• development and testing of prototypes or models</li><li>• colour fastness</li><li>• testing of fixing mechanisms, glues and finishes</li><li>• protection of precious components</li><li>• transportability</li></ul>
<b>Design documentation</b>	Design documentation may include: <ul style="list-style-type: none"><li>• drawings and illustrations</li><li>• photographs</li><li>• specifications</li><li>• production plan</li></ul>
<b>OHS considerations</b>	OHS considerations may include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• award provisions</li></ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

# **MEM19042A Render images using computer graphics software**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to render 3D images using computer-based software.

## **Application of the Unit**

This unit applies to designers who use computer-based software to produce rendered images of their design to facilitate construction or for promotional purposes.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM19024A Use CAD to create and display 3D jewellery and object models

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Not applicable.

## **Elements and Performance Criteria**

- |                                  |   |
|----------------------------------|---|
| 1 Analyse rendering requirements | 1.1 Explain the features of rendering software packages used in the design industry     |
|                                  | 1.2 Analyse the design brief or other reference sources to plan and determine rendering |

- requirements
- 2 Select a suitable rendering application to achieve desired appearance
  - 2.1 Select rendering software with capability to achieve the desired effects within timeframe and budget
  - 2.2 Confirm selection is in accordance with design brief, system limitations and requirements
- 3 Prepare rendering application for desired outcome
  - 3.1 Select and apply appropriate image resolutions
  - 3.2 Select and apply appropriate image aspect ratio
  - 3.3 Select and apply appropriate pixel ratio
  - 3.4 Adjust renderer attributes to obtain desired anti-aliasing
  - 3.5 Adjust renderer attributes to obtain other desired visual effects
- 4 Check render integrity and quality
  - 4.1 Test and refine render integrity
  - 4.2 Test and re-link any missing images and textures
  - 4.3 Test render times for optimising process
  - 4.3 Test alpha channels and opacity matts
  - 4.4 Test render layers and passes
- 5 Optimise images for render processes
  - 5.1 Complete all relevant pre-rendering optimisations tasks
  - 5.2 Adjust and refine renderer attributes to optimise render times
  - 5.3 Select appropriate file format for output in accordance with the brief
  - 5.4 Select appropriate file names and output destinations
- 6 Render images and save files appropriately
  - 6.1 Undertake final rendering processes
  - 6.2 Store/archive files
  - 6.3 Review completed render to ensure compliance with system and brief

## Required Skills and Knowledge

Required knowledge includes:

- 3D modelling
- 3D animation
- lighting
- shading
- texturing
- rendering principles
- appropriate file sizes and file formats

Required skills include:

- using advanced computer graphics applications
- managing time and resources
- producing original and brief responsive renderings
- communicating effectively with colleagues and clients
- scheduling of production components
- using computer networks for rendering
- interpreting design briefs

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce rendered images which illustrate features of designs.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• adhere to design brief requirements</li><li>• design and comprehend rendering tasks</li><li>• use and refine render components for best performance</li><li>• adhere to systems requirements in relation to file sizes and formats</li><li>• store rendered components in an organised manner for any further use.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS</li></ul>



	<p>practices.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> <li>• Assessment requires access to relevant computer hardware and 3D software, as well as models and/or scenes to be rendered. These may include: <ul style="list-style-type: none"> <li>• computer workstation</li> <li>• 3D animation software</li> <li>• storyboard/script</li> <li>• rendering software</li> <li>• input device (e.g. stylist tablet, keyboard and mouse)</li> <li>• output device (e.g. monitor, TV, printer and speakers)</li> <li>• style shots</li> <li>• rendering briefs/specifications and schedules.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy</p>

	capacity of the candidate and the work being performed.
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## Range Statement

<b>Planning tasks</b>	<p>Planning tasks may include:</p> <ul style="list-style-type: none"> <li>• research</li> <li>• production planning</li> <li>• production management</li> <li>• team discussions</li> <li>• lighting</li> <li>• texturing</li> <li>• shading</li> <li>• networking</li> </ul>
<b>Pre-rendering optimisation tasks</b>	<p>Pre-rendering optimisation tasks may include:</p> <ul style="list-style-type: none"> <li>• selection of most appropriate renderers for specific outcomes</li> <li>• assessing options with key personnel</li> <li>• deleting any unnecessary geometry and components</li> <li>• preparing renderers attributes</li> <li>• preparing layer/pass control</li> <li>• preparing opacity mattes and alpha channels</li> <li>• testing and diagnosing rendering issues</li> <li>• optimising and refining for best render performance</li> <li>• rendering</li> <li>• organisation of output</li> </ul>
<b>Equipment and media</b>	<p>Equipment and media may include:</p> <ul style="list-style-type: none"> <li>• computer workstation</li> <li>• ergonomic furniture</li> <li>• 3D animation software</li> <li>• rendering software</li> <li>• render network distribution software</li> <li>• hub/s</li> <li>• switches</li> <li>• input device (e.g. stylist tablet, keyboard and mouse)</li> <li>• output device (e.g. monitor, TV, printer and speakers)</li> <li>• render farm</li> </ul>
<b>Relevant personnel</b>	<p>Relevant personnel may include:</p>

	<ul style="list-style-type: none"><li>• designer</li><li>• modeller</li><li>• texturer</li><li>• animator</li><li>• programmer</li><li>• technical director</li><li>• systems support officer</li></ul>
<b>Software</b>	Software may include, but is not limited to: <ul style="list-style-type: none"><li>• 3D Studio Max</li><li>• Animator Pro</li><li>• AutoCAD</li><li>• AutoCAD Revit 9</li><li>• Blender</li><li>• Cinema 4D</li><li>• Combustion</li><li>• CorelDraw</li><li>• Electric Image</li><li>• Form Z</li><li>• Houdini</li><li>• Illustrator</li><li>• Lightwave</li><li>• Maya</li><li>• Pixie</li><li>• POV-Ray</li><li>• Renderman</li><li>• Rhino</li><li>• Photoshop</li><li>• Shake</li><li>• Soft Image/XSI</li><li>• Z Brush</li></ul>

## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

## **MEM19043A *Oversee jewellery or object design production***

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to manage the production of jewellery or objects to ensure they comply with design specifications and quality standards.

### **Application of the Unit**

This unit applies to designers who are responsible for producing jewellery and object designs. This unit covers the management of the production process and the implementation of a prototype. It includes working with other specialists and industry suppliers to ensure that design specifications and intent are achieved in the final product. Production may be of one-off or mass produced items and be manufactured in-house or using external resources.

This unit requires extensive skills and knowledge in jewellery and object design, materials and construction techniques. High level judgement is required in planning and selecting appropriate processes or procedures.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

### **Elements and Performance Criteria**

- |                               |   |
|-------------------------------|---|
| 1 Select production processes | 1.1 Examine design brief and specifications to determine required production expertise and services for jewellery or object |
|-------------------------------|---|

- 1.2 Establish quality and service criteria for production processes
  - 1.3 Research possible jewellery or object suppliers or manufacturers and select most suitable resources
  - 1.4 Confirm that production process meets organisational objectives and performance systems
  - 1.5 Document production brief and plan
- 2 Brief production personnel
  - 2.1 Negotiate production arrangements and establish performance targets with key production personnel
  - 2.2 Assign tasks according to available expertise and production requirements
  - 2.3 Provide and explain jewellery or object design specifications, drawings, and all relevant information to production personnel
  - 2.4 Establish relevant technical, monitoring and reporting procedures
- 3 Monitor production
  - 3.1 Maintain ongoing communication with personnel to ensure obligations, quality, timelines, budget and technical constraints are met
  - 3.2 Address problems and make production modification decisions as required
  - 3.3 Ensure production changes are documented and reflected in design documentation
  - 3.4 Monitor production activities to ensure compliance with occupational health and safety (OHS) practices
- 4 Evaluate final product
  - 4.1 Collate and evaluate information on development process
  - 4.2 Assess jewellery or object outcome against specifications
  - 4.3 Assess production outcomes with personnel to review strengths and weaknesses of process
  - 4.4 Assess actual costs against projected costs and identify reasons for discrepancies
  - 4.5 Complete all production and design documentation to inform reproduction

## Required Skills and Knowledge

Required knowledge includes:

- supply chain management
- outsourcing arrangements
- cost-benefit analysis methods
- research resources and techniques for investigating design information
- elements and principles of design as they relate to design of jewellery and objects
- jewellery designs (e.g. shanks, settings styles, shoulders and decorative finishes)
- working properties of jewellery materials
- methods of production for jewellery and objects
- design resources
- brainstorming and other idea generation techniques for research/idea development
- elements and principles of design, including form, harmony and line
- design considerations
- drawing media and their functions/applications, including paper, watercolours, pastels/inks/pencils
- drawing tools and their functions/applications, including stencils and rubbers
- design documentation
- form drawing development
- options available for drawing presentation
- enhancement techniques
- types of working drawings and their uses
- the interrelation between technical and design drawings
- hazard and control measures associated with preparing jewellery designs
- safe work practices

Required skills include:

- providing a design brief
- selecting production processes
- making decisions
- solving problems
- prioritising
- communicating effectively with personnel
- selecting, interpreting and applying procedures or processes
- preparing and presenting documentation and information
- sequencing operations
- meeting specifications
- clarifying and checking task-related information
- determining and assessing OHS practices for work
- reading and interpreting information on specifications, design documentation, illustrations, design drawings and other applicable source documents
- documenting and maintaining design process, features and design development notes

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to oversee the production of a range of jewellery or objects to design specifications and according to production criteria.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• select and plan processes for production from designs</li> <li>• ensure production meets efficiency and quality standards</li> <li>• check compliance with specifications</li> <li>• communicate effectively with team members</li> <li>• solve production problems</li> <li>• monitor production progress and changes</li> <li>• monitor application of OHS practices in production operations</li> <li>• maintain accurate records.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and</li> </ul>

	<p>application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>Quality and service criteria for production</b>	<p>Quality and service criteria for production may include:</p> <ul style="list-style-type: none"> <li>• delivery</li> <li>• material quality</li> <li>• availability of resources</li> <li>• quality of components</li> <li>• standard of work</li> <li>• cost</li> <li>• timelines</li> <li>• capability of personnel</li> <li>• experience</li> <li>• specific expertise</li> </ul>
<b>Production arrangements</b>	<p>Production arrangements may include:</p> <ul style="list-style-type: none"> <li>• costs</li> <li>• timelines</li> <li>• quality standards</li> <li>• key personnel</li> <li>• materials</li> <li>• preferred processes, designs and techniques</li> </ul>
<b>Design documents</b>	<p>Design documents may include:</p> <ul style="list-style-type: none"> <li>• sketches</li> <li>• illustrations</li> <li>• concept drawings</li> <li>• working drawings</li> </ul>



	<ul style="list-style-type: none"><li>• technical data</li><li>• supporting information</li><li>• specifications</li><li>• production plans</li></ul>
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## Unit Sector(s)

Jewellery and horological

## Custom Content Section

Not applicable.

# MEM19044A Repair and restore antique jewellery

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to use jewellery repair techniques in the repair and restoration of antique or traditional jewellery items.

## Application of the Unit

This unit applies to restoration and repair work conducted on antique, traditional or period jewellery where the finish must be consistent with the characteristics of the item.

Work includes use of jewellery equipment.

**Band A**

**Unit Weight 4**

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                                     |     |   |
|---|-------------------------------------|-----|---|
| 1 | Determine work requirements         | 1.1 | Clarify client requirements for work  |
|   |                                     | 1.2 | Identify the era and design characteristics of the jewellery item and the materials and construction techniques used  |
|   |                                     | 1.3 | Conduct research into the item characteristics, as required, to inform work   |
|   |                                     | 1.4 | Examine the item to determine condition and extent of work requirements and determine feasibility of completing work to standard required                               |
|   |                                     | 1.5 | Determine storage and handling requirements for item to ensure protection from damage   |
| 2 | Plan repair or restoration work     | 2.1 | Determine requirements for jewellery item repair or restoration and develop work plan   |
|   |                                     | 2.2 | Estimate costs and confirm viability against client requirements and budget   |
|   |                                     | 2.3 | Determine requirement for manufacture of new componentry or sourcing of specialist expertise  |
|   |                                     | 2.4 | Confirm feasibility of repair work to achieve quality outcome   |
|   |                                     | 2.5 | Source materials, equipment, components and specialist expertise required to complete work  |
| 3 | Conduct repair and restoration work | 3.1 | Select and use tools, equipment, materials and consumables appropriate to job requirements in accordance with manufacturer specifications and organisational procedures |
|   |                                     | 3.2 | Apply repair and restoration techniques to jewellery item in accordance with the style of the item  |
|   |                                     | 3.3 | Identify and address unforeseen consequences of work  |

- |   |             |  |
|---|-------------|--|
|   | 3.4         | Observe occupational health and safety (OHS) requirements and safely operate all workshop equipment used |
|   | 3.5         | Perform work in a manner that minimises waste and complies with environmental requirements               |
| 4 | Finish work |  |
|   | 4.1         | Check work meets client requirements and quality standards   |
|   | 4.2         | Determine safe cleaning techniques for antique item to ensure features are protected from damage         |
|   | 4.3         | Clean item and prepare for presentation to client  |
|   | 4.4         | Complete documentation on work undertaken  |
|   | 4.5         | Clean up work area   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading and interpreting routine information on written job instructions, specifications, standard operating procedures and drawings
- interpreting client requirements
- analysing characteristics of antique jewellery
- costing work
- completing work by hand according to job requirements
- interpreting drawings
- weighing and measuring
- selecting appropriate tools and equipment
- selecting appropriate materials and repair/manufacturing techniques
- applying appropriate fabrication and finishing procedures
- working safely
- identifying alternative metals

## Required knowledge

Required knowledge includes:

- information sources on antique jewellery
- range of techniques used in antique jewellery construction
- characteristics and responses of metals and common materials used in antique jewellery
- reasons for selecting particular metals, construction methods, repair/manufacturing and finishing techniques
- workplace hazards and emergency procedures
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to repair and restore a range of antique jewellery items in a manner which is consistent with the style and era of the item.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures to safely and effectively use jewellery repair and construction equipment and processes</li> <li>• determine the requirements for repair or restoration</li> <li>• source and apply information on antique jewellery</li> <li>• conduct a range of repair and restoration techniques to ensure quality standards and client requirements are met.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> </ul>

	<ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>gold, silver and platinum</li> <li>precious or semi-precious stones</li> <li>coral, shells, leather, copper and copper alloys, enamel, glass, ceramic, feathers, insect cases, bone and ivory, hair and paper</li> </ul>
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<b>Repair or restoration work</b>	<p>Repair or restoration work may relate to:</p> <ul style="list-style-type: none"> <li>• wear and tear</li> <li>• chipped stones or enamel</li> <li>• broken or weak clasps or componentry</li> <li>• scratched surfaces</li> <li>• tarnished or dirty metals</li> <li>• encrusting of components with foreign objects</li> <li>• deterioration</li> <li>• light damage</li> <li>• stains</li> </ul>
<b>Repair and restoration techniques</b>	<p>Repair and restoration techniques may include:</p> <ul style="list-style-type: none"> <li>• retipping</li> <li>• reshank</li> <li>• restoration</li> <li>• new collets</li> <li>• chain repairs</li> <li>• fastening mechanism repairs</li> <li>• replacement or reconstruction of componentry</li> <li>• refinishing</li> <li>• cleaning</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• wearing personal protective equipment in the jewellery workshop</li> <li>• aprons</li> <li>• protective foot wear</li> <li>• eye protection while operating rotary equipment</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>

## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.



# MEM19045A Set gems in channel style settings

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to prepare, seat and set gems into channel style settings.

## Application of the Unit

This unit applies to pre-manufactured jewellery items and must include application of both tapered and parallel channel setting techniques. Gem materials include round brilliant and baguette shaped stones.

Work includes use of gem setting equipment and cleaning and inspection of the work produced.

**Band A**

**Unit Weight 4**

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                            |   |
|---|----------------------------|---|
| 1 | Prepare for gem setting    | <p>1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area</p> <p>1.2 Plan gem setting procedure</p> <p>1.3 Obtain and prepare equipment for the task and make modifications as required for work</p> <p>1.4 Identify materials used in channel settings and their essential characteristics</p> <p>1.5 Handle gem in a manner which ensures damage is prevented</p> <p>1.6 Determine the characteristics and purpose of channel in setting gem material</p>  |
| 2 | Construct channel settings | <p>2.1 Secure the item to be set in a manner which negates damage to the jewellery piece during the setting process</p> <p>2.2 Check the thickness, width and length of the channel construction in regard to the gem dimension to be set</p> <p>2.3 Prepare, lay out and cut the appropriate channel to suit the gem shape and number to be set</p> <p>2.4 Cut the bearing by hand or with a burr and seat the gem in accordance with industry standards</p> <p>2.5 Form the channel edge by hand or with an automatic hammer handpiece to secure the gem in the setting, including executing a bright cut on the inside edge of the channel</p> |
| 3 | Finish work                | <p>3.1 Remove any securing compound and clean the jewellery piece for inspection</p>  |

- 3.2 Ensure that jewellery piece meets quality standards
- 3.3 Complete workplace documentation
- 3.4 Clean up and maintain production environment and equipment according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting and preparing tools
- identifying metals
- identifying gem features
- adjusting, sharpening and maintaining tools
- preparing metals
- securing gems
- calculating required material size
- securing the jewellery item to be set without inflicting damage
- selecting the appropriate depth and spacing at which to cut the bearing on the inside of the channel wall
- seating the gem level and straight in the channel that has been prepared
- securing the gem by forming the channel wall over the gem
- finishing the top of the channel to reflect industry standard
- applying techniques for handling gem safely and minimising stress during setting processes
- reading and interpreting routine information on written job instructions, specifications, standard operating procedures and drawings

### Required knowledge

Required knowledge includes:

- setting terminology
- gem features and handling procedures
- maintenance of tools
- setting techniques, processes and procedures
- working properties of gems
- suitability of metal for carving and setting

- essential characteristics of various styles of channel settings
- various securing techniques for jewellery items to be set
- safe operation all workshop equipment used

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to prepare, seat and set gems into channel style settings.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• produce a channel setting reflective of industry standard</li> <li>• use the safety equipment provided appropriately</li> <li>• demonstrate safe working operations at all times</li> <li>• applying techniques for handling gems safely and minimising stress during setting processes.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with</li> </ul>

	<p>application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• personal protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Materials used in channel settings</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>• gemstones</li> <li>• natural stones</li> <li>• modified and synthetics gems</li> <li>• gold</li> <li>• silver</li> <li>• platinum</li> </ul>

	<ul style="list-style-type: none"> <li>• cast and handmade alloys</li> <li>• faceted and cabochon cut gems in either calibrated or freeform shapes</li> </ul>
<b>Gem setting tools and equipment</b>	<p>Gem setting tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• gravers</li> <li>• grinders</li> <li>• micro-motors</li> <li>• polishing machines</li> <li>• sharpening stones</li> <li>• setters wax/cement</li> <li>• jewellers burrs/drills</li> <li>• 10X loupe or head set</li> <li>• emery paper</li> <li>• flat and half pliers</li> <li>• needle files</li> <li>• pocket knife</li> <li>• oil</li> <li>• workbench</li> <li>• blocks or dowels covered with setters cement</li> <li>• bench mate setters clamp</li> <li>• engravers vice</li> <li>• bench vice</li> <li>• hand held setters clamp</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>

## **Unit Sector(s)**

Jewellery

## **Custom Content Section**

Not applicable.

# **MEM19046A Apply grain setting techniques**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply grain setting techniques to set gem setting.

## **Application of the Unit**

This unit applies to pre-manufactured jewellery items and must include application of pave', thread and grain, and single stone bead set techniques to produce a variety of completed settings.

Work includes use of gem setting equipment and cleaning and inspection of the work produced.

**Band A**

**Unit Weight 4**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills



and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                           |   |
|---|---------------------------|---|
| 1 | Prepare for grain setting | <p>1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area</p> <p>1.2 Define the characteristics and purpose of grain in a setting</p> <p>1.3 Define the characteristics of pave', thread and grain, and single stone bead set</p> <p>1.4 Plan grain setting procedure</p> <p>1.5 Obtain and prepare equipment for the task and make modifications as required for work</p> <p>1.6 Identify materials used and their essential characteristics</p> <p>1.7 Handle gems in a manner which ensures damage is prevented</p>   |
| 2 | Prepare grain setting     | <p>2.1 Secure the item to be set in a manner which negates damage to the jewellery piece during the setting process</p> <p>2.2 Drill and countersink the item producing a bearing to suit gem diameter</p> <p>2.3 Seat the gem in the bearing opening checking the gem is at the correct height, straight and level</p> <p>2.4 Raise the grains using various shaped gravers and bead the grains over to secure the gem</p> <p>2.5 Form the grains into beads using a beading tool to secure the gem</p> <p>2.6 Perform the final bright cutting using either a flat or onglette graver</p> <p>2.7 Conduct work in accordance with environmental considerations</p> |

- |   |             |     |  |
|---|-------------|-----|--|
| 3 | Finish work | 3.1 | Remove any securing compound and clean the jewellery piece for inspection                                    |
|   |             | 3.2 | Apply techniques for inspection and quality control of the setting work produced through a 10X magnification |
|   |             | 3.3 | Ensure that jewellery piece meets quality standards  |
|   |             | 3.4 | Complete workplace documentation   |
|   |             | 3.5 | Clean up and maintain production environment and equipment according to enterprise procedures                |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting and preparing tools
- identifying metals
- identifying gem features
- adjusting, sharpening and maintaining tools
- preparing metals
- securing gems
- calculating required material size
- securing the jewellery item to be set without inflicting damage
- marking out and drilling the layout for the gem to be grain set
- selecting the appropriate depth at which to countersink and form a bearing reflective of the gem height
- seating the gem material level and straight in the bearing
- securing the gem by raising two or more grains over the gem
- using gravers to remove excess metal from around the gem to highlight the reflective properties of the gem
- choosing the correct size beading tool and form the grains into beads over the gem
- bright cutting the edges of the setting area using gravers to finish the setting work in accordance with industry standards
- applying techniques for handling gems safely and minimising stress during setting processes

## Required knowledge

Required knowledge includes:

- setting terminology
- gem features and handling procedures
- maintenance of tools
- setting techniques, processes and procedures
- working properties of gems
- suitability of metal for carving and setting
- essential characteristics of various styles of grain settings
- various securing techniques for jewellery items to be set
- spacing and layout techniques for pave' setting
- safe operation all workshop equipment used

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to produce a variety of pave', thread and grain, and single stone bead settings.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures to safely and effectively use grain setting equipment and processes</li> <li>• apply techniques for handling materials safely and minimising gem stress during setting processes</li> <li>• produce various styles of grain setting, including pave', thread and grain, and single stone bead setting.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics</li> </ul>

	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>legislation</li> <li>personal protective equipment</li> <li>material safety management systems</li> <li>hazardous substances and dangerous goods code</li> </ul>
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	<ul style="list-style-type: none"> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Gem materials</b>	<p>Gem materials may include:</p> <ul style="list-style-type: none"> <li>• gemstones</li> <li>• round brilliant and baguette shaped stones</li> <li>• natural stones</li> <li>• modified and synthetics gems</li> <li>• faceted and cabochon cut gems in either calibrated or free-form shapes</li> <li>• gold</li> <li>• silver</li> <li>• platinum</li> <li>• cast and handmade alloys</li> </ul>
<b>Grain setting tools and equipment</b>	<p>Grain setting tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• gravers</li> <li>• grinders</li> <li>• micro motors</li> <li>• polishing machines</li> <li>• sharpening stones and beading tools</li> <li>• setters wax/cement</li> <li>• jewellers burrs/drills</li> <li>• 10X loupe or head set</li> <li>• emery paper</li> <li>• flat and half pliers</li> <li>• needle files</li> <li>• pocket knife</li> <li>• oil</li> <li>• blocks or dowels covered with setters cement</li> <li>• bench mate setters clamp</li> <li>• engravers vice</li> <li>• bench vice</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>

## **Unit Sector(s)**

Jewellery

## **Custom Content Section**

Not applicable.

## MEM19047A Set gems in claw and bezel style settings

### Modification History

New unit

### Unit Descriptor

This unit of competency covers the skills and knowledge required to prepare, seat and set gems into claw and bezel style settings.

### Application of the Unit

This unit applies to pre-manufactured jewellery items and must include application of both claw and bezel setting techniques to produce a variety of completed settings. Bezel settings must include set faceted and cabochon gem material. Claw settings must include round or shaped wire.

Work includes use of gem setting equipment and cleaning and inspection of the work produced.

**Band A**

**Unit Weight**                      **4**

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a      Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Prepare for gem setting	1.1	Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the tasks and for the work area
		1.2	Define the characteristics of bezels, including full and part bezels, along with bezel construction types
		1.3	Plan gem setting procedure
		1.4	Obtain and prepare equipment for the task and make modifications as required for work
		1.5	Identify materials used in bezel and claw settings and their essential characteristics
		1.6	Handle gem material in a manner which ensures damage is prevented
2	Prepare various shapes and types of bezels for setting	2.1	Secure the item to be set, in a manner which negates damage to the jewellery piece during the setting process
		2.2	Adjust the height of the bezel in accordance to the depth of the gem
		2.3	Cut the bearing by hand or with a burr and seat and secure gem in accordance with industry standards
		2.4	Shape the top of the bezel wall and bright cut the inner edge as required by the shape
		2.5	Conduct work in accordance with environmental considerations
3	Prepare claw settings	3.1	Describe advantages and disadvantages of 2,4,6,8,12 wire settings and 'V' wire claw settings
		3.2	Prepare claw for setting and select the height and depth



- of the bearing to be cut
- 3.3 Cut the bearing by hand or with a burr and seat the gem in accordance with industry standards.
  - 3.4 Form the claw to secure the gem in the setting, including finishing the top of the claw to a predetermined shape without damaging the gem
- 4 Finish work
- 4.1 Remove any securing compound and clean the jewellery piece for inspection
  - 4.2 Ensure that jewellery piece meets quality standards
  - 4.3 Complete workplace documentation
  - 4.4 Clean up and maintain production environment and equipment according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting and preparing tools
- identifying metals
- identifying gem features
- adjusting, sharpening and maintaining tools
- preparing metals
- securing gems
- calculating required material size
- securing the jewellery item to be set without inflicting damage
- selecting the appropriate height and depth at which to cut the bearing on the wire of the claw setting
- seating the gem level and straight in the claw setting
- securing the gem by pushing the claw wire over the gem
- finishing the top of the claw to desired shape
- selecting the appropriate height and depth at which to cut the bearing on the inside of the bezel wall

- seating the gem level and straight in the bezel setting
- securing the gem by pushing the bezel wall over the gem
- finishing the top of the bezel to desired shape
- applying techniques for handling gems safely and minimising stress during setting processes

## Required knowledge

Required knowledge includes:

- setting terminology
- gem features and handling procedures
- maintenance of tools
- setting techniques, processes and procedures
- working properties of materials
- types of gems and their key characteristics
- range of facet cuts used on gems
- qualities, features, limitations and working characteristics of different metals used in jewellery
- suitability of metal for carving and setting
- essential characteristics of wire claw settings
- essential characteristics of various styles of bezel settings
- various securing techniques for jewellery items to be set
- safe operation all workshop equipment used

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to produce a variety of both claw and bezel settings.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• implement OHS workplace procedures to safely and effectively use gem setting equipment and processes</li><li>• apply techniques for handling gems safely and minimising stress during setting processes</li><li>• produce claw and bezel settings according to industry</li></ul>

	standards.
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work

environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• personal protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Gem materials</b>	<p>Gem materials may include:</p> <ul style="list-style-type: none"> <li>• gemstones</li> <li>• round brilliant and baguette shaped stones</li> <li>• natural stones</li> <li>• modified and synthetic gems</li> <li>• faceted and cabochon cut gems in either calibrated or free-form shapes</li> <li>• gold</li> <li>• silver</li> <li>• platinum</li> <li>• cast and handmade alloys</li> </ul>
<b>Setting tools and equipment</b>	<p>Setting tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• gravers</li> <li>• grinders</li> <li>• micro-motors</li> <li>• polishing machines</li> <li>• sharpening stones and beading tools</li> <li>• setters wax/cement</li> <li>• jewellers burrs/drills</li> <li>• 10X loupe or head set</li> <li>• emery paper</li> <li>• flat and half pliers</li> <li>• needle files</li> <li>• pocket knife</li> <li>• oil</li> <li>• blocks or dowels covered with setters cement</li> <li>• bench mate setters clamp</li> <li>• engravers vice</li> <li>• bench vice</li> </ul>

<b>Environmental requirements</b>	Environmental requirements may relate to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

## **MEM19048A Develop and apply complex borders and decorations for hand engraving**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to engrave a variety of complex borders and ornate decorations on a variety of metal surfaces.

### **Application of the Unit**

This unit applies to engraving items, such as jewellery and metal objects, according to client requirements. Engraving includes complex borders and decorations, such as floral panels, geometric shapes, logos, crests and ciphers.

Work includes use of engraving equipment and inspection of the work produced.

**Band B**

**Unit Weight 4**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

unit of competency. and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Plan complex borders and ornate decorations for engraving	1.1	Identify and list elements of various border designs and decorative drawing styles for engraving
		1.2	Determine client requirements for border designs and decoration
2	Develop designs to meet client requirements	2.1	Develop complex designs for borders and decorations to predetermined dimensions and client requirements
		2.2	Use computer-based tools to explore and develop complex borders and decorative designs to predetermined dimensions and client requirements
3	Mark out border and decorative layouts on metal surface	3.1	Identify techniques to reduce or enlarge designs to predetermined dimensions according to client requirements
		3.2	Accurately mark out lettering and/or monogram and cipher layouts on metal surfaces to be engraved using predetermined reference/datum points
4	Perform hand engraving	4.1	Perform engraving of complex and ornate style borders to a commercial industry standard
		4.2	Perform engraving of complex and ornate decorative layouts to a commercial industry standard
		4.3	Perform work in a manner that minimises waste and complies with environmental requirements
		4.4	Observe occupational health and safety (OHS) requirements and safely operate all workshop equipment used

- |   |             |     |   |
|---|-------------|-----|---|
| 5 | Finish work | 5.1 | Check engraving meets client requirements and quality standards |
|   |             | 5.2 | Clean item and prepare for presentation to client               |
|   |             | 5.3 | Clean up work area  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- interpreting client requirements
- identifying the engraving sequence
- using drawing tools
- selecting and using gravers, scorpers and other applicable tools
- controlling engraving tools
- drawing decorative borders and other design work to required dimensions
- using datum lines/points
- skilfully laying out and transferring designs for lettering, monograms and ciphers onto metal surfaces
- machining and sharpening graver shape and cutting angles
- handling and securing work pieces
- maintaining points/cutting edges/polished faces
- completing fine engraving work by hand

### Required knowledge

Required knowledge includes:

- engraving terminology
- sources of task-related information
- historic and cultural sources for complex borders and decorative design styles
- design research techniques
- elements and principles of design as applied to border and surface decoration design
- characteristics and responses of metals for engraving purposes
- securing methods and limitations



- different gravers, scorpers and other tools and their applications
- techniques for producing and maintaining cutting edges
- equipment used for maintaining gravers
- required industry standards
- tool maintenance
- basic hand engraving techniques
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to engrave a variety of complex borders and decorations on a range of metal surfaces.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement OHS workplace procedures to safely and effectively use engraving equipment and processes</li><li>• produce aesthetically pleasing decorative design work demonstrating application of the elements and principles of design</li><li>• engrave with appropriate spacing and height of borders and decorative design work</li><li>• represent appropriate fine line detail and shading</li><li>• complete and present design and layout work that is clean, accurate and meets with client approval</li><li>• produce work according to commercial standards.</li></ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"><li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li></ul>

	<ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Complex border designs</b>	Complex border designs may include: <ul style="list-style-type: none"> <li>floral patterns</li> <li>geometric patterns</li> </ul>
<b>Complex decorations</b>	Complex decorations may include: <ul style="list-style-type: none"> <li>floral panels</li> </ul>

	<ul style="list-style-type: none"> <li>• geometric shapes</li> <li>• logos, crests and ciphers</li> </ul>
<b>Metal surfaces</b>	<p>Metal surfaces may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• gold</li> <li>• silver</li> <li>• platinum</li> <li>• alloys</li> </ul>
<b>Computer-based tools</b>	<p>Computer-based tools may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• computer-generated fonts</li> <li>• word processing applications</li> <li>• vector based and bitmap drawing applications</li> <li>• desktop publishing applications</li> <li>• printers</li> </ul>
<b>Elements and principles of design</b>	<p>Elements and principles of design may include:</p> <ul style="list-style-type: none"> <li>• line and direction</li> <li>• shape and size</li> <li>• texture, colour and value</li> <li>• harmony</li> <li>• contrast</li> <li>• dominance</li> <li>• repetition</li> <li>• gradation and radiation</li> <li>• unity</li> <li>• proportion</li> <li>• alternation</li> <li>• balance</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• wearing personal protective equipment in the jewellery workshop</li> <li>• aprons</li> <li>• protective foot wear</li> <li>• eye protection while operating rotary equipment</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> </ul>

	<ul style="list-style-type: none"><li>• excessive noise</li></ul>
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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

# **MEM19049A Develop and apply heraldic designs for hand engraving**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to engrave a variety of complex heraldic designs and layouts onto various metal surfaces.

## **Application of the Unit**

This unit applies to engraving items, such as jewellery and metal objects, according to client requirements. Engraving includes heraldic designs, such as College of Arms, crests, coats of arms and flag designs.

Work includes use of engraving equipment and inspection of the work produced.

**Band A**

**Unit Weight 2**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

unit of competency. and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Research heraldic designs and identify requirements for engraving	1.1	Research heraldic designs for hand engraving
		1.2	Determine client requirements for application of the heraldic design onto the metal surface
2	Develop heraldic designs	2.1	Plan the layout for the heraldic design according to predetermined dimensions and client requirements
		2.2	Use computer-based tools to explore and develop heraldic designs for hand engraving
3	Mark out layout of heraldic designs to be engraved	3.1	Identify techniques to reduce or enlarge designs to predetermined dimensions according to client requirements
		3.2	Accurately mark out heraldic layouts on metal surfaces to be engraved using predetermined reference/datum points
4	Perform hand engraving of heraldic designs	4.1	Perform heraldic crest hand engraving to predetermined stipulations/dimensions
		4.2	Perform engraving of ornate style heraldic crests to a commercial industry standard
		4.3	Perform engraving of heraldic shields
		4.4	Perform engraving of heraldic helmets
		4.5	Perform work in a manner that minimises waste and complies with environmental requirements
		4.6	Observe occupational health and safety (OHS) requirements and safely operate all workshop equipment

used

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|---|-------------|-----|---|
| 5 | Finish work | 5.1 | Check engraving meets client requirements and quality standards |
|   |             | 5.2 | Clean item and prepare for presentation to client               |
|   |             | 5.3 | Clean up work area  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- interpreting client requirements
- identifying the engraving sequence
- using drawing tools
- using datum lines/points
- drawing decorative borders and other design work to required dimensions
- applying block/script lettering and carving techniques to achieve patterns in relief or intaglio
- skilfully laying out and transferring heraldic designs onto metal surfaces
- selecting and using gravers, scorpers and other applicable tools
- controlling engraving tools
- machining and sharpening graver shape and cutting angles
- handling and securing work pieces
- maintaining points/cutting edges/polished faces
- completing fine engraving work by hand

### Required knowledge

Required knowledge includes:

- historic and cultural sources of heraldic designs
- design research techniques

- elements and principles of design as applied to applications of hand engraved designs to a range of metal surfaces
- characteristics and responses of metals for engraving purposes
- engraving terminology
- sources of task-related information
- securing methods and limitations
- different gravers, scorpers and other tools and their applications
- techniques for producing and maintaining cutting edges
- equipment used for maintaining gravers
- required industry standards
- tool maintenance
- hand engraving techniques
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to engrave a variety of heraldic designs on a range of metal surfaces.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• implement OHS workplace procedures to safely and effectively use engraving equipment and processes</li> <li>• source heraldic designs to meet customer requirements</li> <li>• appropriately position and transfer heraldic design onto the object to be engraved</li> <li>• represent fine line detail and shading</li> <li>• design work that meets with client approval and is consistent with commercial standards.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> </ul>



	<ul style="list-style-type: none"> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Heraldic designs</b>	<p>Heraldic designs may include:</p> <ul style="list-style-type: none"> <li>College of Arms as a repository of information for</li> </ul>
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	<p>historical and cultural sources</p> <ul style="list-style-type: none"> <li>• crests</li> <li>• coats of arms</li> <li>• flag designs</li> </ul>
<b>Metal surfaces</b>	<p>Metal surfaces may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• gold</li> <li>• silver</li> <li>• platinum</li> <li>• alloys</li> </ul>
<b>Computer-based tools</b>	<p>Computer-based tools may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• computer-generated fonts</li> <li>• word processing applications</li> <li>• vector based and bitmap drawing applications</li> <li>• desktop publishing applications</li> <li>• printers</li> </ul>
<b>Elements and principles of design</b>	<p>Elements and principles of design may include:</p> <ul style="list-style-type: none"> <li>• line and direction</li> <li>• shape and size</li> <li>• texture, colour and value</li> <li>• harmony</li> <li>• contrast</li> <li>• dominance</li> <li>• repetition</li> <li>• gradation and radiation</li> <li>• unity</li> <li>• proportion</li> <li>• alternation</li> <li>• balance</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• wearing personal protective equipment in the jewellery workshop</li> <li>• aprons</li> <li>• protective foot wear</li> <li>• eye protection while operating rotary equipment</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including</li> </ul>

	<ul style="list-style-type: none"><li>fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

## **MEM19050A Hand carve engraving work**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to engrave/carve in relief onto a variety of jewellery or object surfaces.

### **Application of the Unit**

This unit applies to engraving work, which includes seal carving and relief carving, on both concave and convex surfaces and carving half hoop rings. Work is conducted according to design specification and includes transferring design drawing onto surface for carving. Carving must be conducted on a range of metals surfaces and may also include alternative materials, such as coral, shells, enamel, glass and ceramic, where they are used in the jewellery or object design.

Work includes use of jewellery making equipment.

**Band B**

**Unit Weight 4**

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Confirm work requirements	1.1	Analyse specifications or design drawing to determine carving requirements
		1.2	Determine requirements for drawing modification or resizing in order to fit metal surface
		1.3	Confirm metal surface will respond to carving technique
2	Transfer and mark out design	2.1	Apply techniques to reduce or enlarge the design to a given size
		2.2	Transfer drawing detail onto metal surface
		2.3	Mark out various carving layouts and patterns using predetermined reference/datum points
3	Apply carving techniques	3.1	Select and use tools, equipment, materials and consumables appropriate to job requirements in accordance with manufacturer specifications and organisational procedures
		3.2	Determine need for specialist carving tools and design and produce tools, as required, to complete work
		3.3	Perform engraving carving in accordance with design stipulations
		3.4	Observe occupational health and safety (OHS) requirements and safely operate all workshop equipment used
		3.5	Perform work in a manner that minimises waste and complies with environmental requirements

- |   |             |     |  |
|---|-------------|-----|--|
| 4 | Finish work | 4.1 | Check work meets client requirements and quality standards |
|   |             | 4.2 | Clean item and prepare for presentation to client          |
|   |             | 4.3 | Complete documentation on work undertaken                  |
|   |             | 4.4 | Clean up work area   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- interpreting client requirements
- identifying the engraving sequence
- determining suitability of item and materials for carving work
- using datum lines/points and marking out design
- selecting and using gravers, scorpers and other applicable tools
- controlling engraving tools
- machining and sharpening graver shape and cutting angles
- handling and securing work pieces
- maintaining points/cutting edges/polished faces
- completing work by hand according to job requirements

### Required knowledge

Required knowledge includes:

- range of techniques used for carving
- characteristics and responses of metals and common materials used in jewellery
- engraving terminology
- sources of task-related information
- securing methods and limitations
- different gravers, scorpers and other tools and their applications
- techniques for producing and maintaining cutting edges

- equipment used for maintaining gravers
- required industry standards
- tool maintenance
- hand engraving techniques
- hazards and control measures, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to perform seal carving and relief carving on both concave and convex metals surfaces.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• transfer design onto metal surfaces for carving</li> <li>• implement OHS workplace procedures to safely and effectively carve relief and seal designs on a range of metal surfaces</li> <li>• perform carving to industry standard</li> <li>• determine the requirements for repair or restoration.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Materials</b>	<p>Materials and equipment may include:</p> <ul style="list-style-type: none"> <li>• gold, silver and platinum</li> <li>• precious or semi-precious stones</li> <li>• coral and shells</li> <li>• copper and copper alloys</li> <li>• enamel, glass and ceramic</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• square graver</li> <li>• flat graver</li> <li>• lozenge graver</li> <li>• half round gravers</li> <li>• engravers pad</li> </ul>



	<ul style="list-style-type: none"><li>• scorpers</li><li>• plasticine</li><li>• metal ruler</li><li>• eye loupe</li></ul>
<b>Carving work</b>	Carving work must include: <ul style="list-style-type: none"><li>• seal carving</li><li>• relief carving</li></ul>
<b>OHS requirements</b>	OHS requirements may include: <ul style="list-style-type: none"><li>• wearing personal protective equipment in the jewellery workshop</li><li>• aprons</li><li>• protective foot wear</li><li>• eye protection while operating rotary equipment</li></ul>
<b>Environmental requirements</b>	Environmental requirements may relate to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>

## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

## MEM19051A Construct multiple stone settings

### Modification History

New unit

### Unit Descriptor

This unit of competency covers the skills and knowledge required to apply a range of jewellery making skills in the construction of jewellery that incorporates multiple stone settings.

### Application of the Unit

This unit applies to construction of jewellery that features multiple stone settings and clusters and may be applied to rings, brooches, pendants, and so on. It will involve the application of a range of jewellery construction techniques, such as bezel, shank, claw and eternity rings.

Work includes use of jewellery making equipment.

**Band B**

**Unit Weight 4**

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM19047A Set gems in claw and bezel style settings

MEM19045A Set gems in channel style settings

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Confirm work requirements	1.1	Clarify requirements for work
		1.2	Analyse specifications or design documentation to determine construction requirements
		1.3	Conduct research into design features, as required, to inform work
		1.4	Develop construction plan
		1.5	Estimate costs and confirm viability
2	Research multiple setting styles	2.1	Conduct research into traditional and contemporary applications of multiple stone settings
		2.2	Research jewellery styles that contain multiple stone settings used in rings, pendants, brooches and earrings
		2.3	Document findings covering trends and methods of construction
3	Construct stone setting	3.1	Source materials, equipment and components required to complete work
		3.2	Select and arrange stones or stone sizes in a manner which displays features and works in accordance with their shape and size
		3.3	Construct top plate and/or settings, layers and levels to position stones
		3.4	Mark out stones according to design requirements

- |   |             |   |
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|   | 3.5         | Conduct cutting, annealing, soldering, drilling and other construction techniques to accurately and neatly position stones in cluster setting |
|   | 3.6         | Observe occupational health and safety (OHS) requirements and safely operate all workshop equipment used                                      |
|   | 3.7         | Perform work in a manner that minimises waste and complies with environmental requirements  |
| 4 | Finish work |   |
|   | 4.1         | Check work meets client requirements and quality standards  |
|   | 4.2         | Determine safe cleaning techniques for item to ensure features are protected from damage  |
|   | 4.3         | Clean item and prepare for presentation to client   |
|   | 4.4         | Complete documentation on work undertaken   |
|   | 4.5         | Clean up work area  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting client requirements
- measuring and marking out stones
- analysing characteristics of jewellery design
- costing work
- using jewellery manufacturing tools
- completing work by hand according to job requirements

### Required knowledge

Required knowledge includes:

- range of techniques used in antique jewellery construction
- OHS principles and practices
- characteristics and responses of metals and gems used in jewellery

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to construct an item of jewellery that includes a multiple stone setting and is finished according to industry quality standards.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures to safely and effectively use jewellery construction equipment and processes</li> <li>• plan the design and construction of stone settings</li> <li>• apply a range of jewellery construction techniques to complete multiple stone items of jewellery.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>• gemstones (e.g. diamond, ruby, sapphire and emerald)</li> <li>• ornamental materials (e.g. lapis lazuli and malachite)</li> <li>• biological gem materials (e.g. amber, coral and ivory), and their synthetics and imitations</li> <li>• rocks</li> <li>• non-crystalline materials (e.g. amorphous opal)</li> <li>• glass, plastic and composite stones</li> <li>• gold, silver, platinum, palladium, copper and their alloys</li> </ul>
<b>Multiple stone set jewellery</b>	<p>Multiple stone set jewellery may include:</p> <ul style="list-style-type: none"> <li>• coronet cluster rings/pendants</li> <li>• wire cluster rings</li> <li>• individual setting eternity rings</li> <li>• carved eternity rings</li> </ul>

	<ul style="list-style-type: none"><li>• ribbon style brooches/pendants</li><li>• plate setting brooches</li></ul>
<b>OHS requirements</b>	OHS requirements may include: <ul style="list-style-type: none"><li>• wearing personal protective equipment in the jewellery workshop</li><li>• aprons</li><li>• protective foot wear</li><li>• eye protection while operating rotary equipment</li></ul>
<b>Environmental requirements</b>	Environmental requirements may relate to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>

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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

# **MEM19052A Produce complex objects using silversmithing techniques**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design and create complex objects using a range of silversmithing techniques.

It includes assessing the application of the design brief in the final outcome.

## **Application of the Unit**

This unit requires application of silversmithing techniques in the production of objects where consistency of outcomes is required across multiple items. For example, a cutlery set where a standard of quality and finish must be repeated across many pieces. It also applies to the production of complex pieces, such as tea or coffee sets or trophies, which require extensive soldering operations and complex finishing procedures.

The unit would typically apply to post-trade study or to jewellers specialising in large silver work.

**Band A**

**Unit Weight 4**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM19033A      Create silversmithing objects



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Design a complex object for silversmithing	1.1	Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area
		1.2	Determine requirements from the design brief, research and discussions with appropriate personnel, if required
		1.3	Evaluate relevant research information, references and resources to the design process
		1.4	Record concept development through a range of drawings, notations and design options
		1.5	Prepare production plans for selected design solution and refine design, as appropriate
		1.6	Produce a model or maquette of the selected design
		1.7	Determine and obtain resources and equipment to undertake the task
2	Apply silversmithing techniques	2.1	Implement OHS requirements for carrying out the work
		2.2	Determine appropriate silversmithing techniques and equipment through testing and experimenting, if required
		2.3	Select and apply a range of silversmithing techniques and processes to produce the objects

- |   |   |     |  |
|---|---|-----|--|
|   |   | 2.4 | Determine and apply the appropriate soldering operations for complex items that require a large number of joins to be undertaken |
|   |   | 2.5 | Produce objects to design specifications and ensure consistency across items, as relevant  |
|   |   | 2.6 | Apply knowledge to reduce the production of fire-scale during heating operations   |
|   |   | 2.7 | Apply materials and process knowledge to identify and address production problems or inconsistencies                             |
|   |   | 2.8 | Apply relevant surface finishing techniques to the objects   |
| 3 | Evaluate objects for meeting the design brief | 3.1 | Implement OHS requirements for finishing the work  |
|   |   | 3.2 | Test objects for function against the design brief, if required  |
|   |   | 3.3 | Assess consistency of outcome quality in multiple objects and complex design features  |
|   |   | 3.4 | Evaluate and document design processes   |
|   |   | 3.5 | Clean up and maintain production environment   |
|   |   | 3.6 | Apply appropriate control measures to hazardous substances according to environmental requirements                               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- researching information
- sketching and interpreting drawings
- generating ideas and concepts
- working with a wide range of materials and techniques
- using relevant tools and equipment for producing objects

- preparing and maintaining silversmithing tools and equipment (e.g. hammers, stakes, files and vices)
- applying a range of silversmithing techniques to high standard
- producing work where fire-scale is controlled during production and applying a high standard of finishing skills
- achieving consistency in standards across multiple pieces
- working effectively with others
- communicating effectively

## Required knowledge

Required knowledge includes:

- concept development techniques
- purpose, function and maintenance of silversmithing equipment
- techniques/manufacturing methods for silversmithing production
- soldering techniques for silversmithing
- control measures for fire-scale
- binding and locating techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to apply a range of silversmithing techniques to the design and creation of complex or multiple objects.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement OHS workplace procedures and practices, including the use of risk control measures</li><li>• demonstrate the creation and production of silversmithing objects on more than one occasion and in different contexts. This includes:<ul style="list-style-type: none"><li>• development of a sketchbook of drawings and notations that record:<ul style="list-style-type: none"><li>• ideas and design options generated</li><li>• concept development</li><li>• maquette production</li></ul></li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• relevant research</li> <li>• plans for production solutions</li> <li>• production of tests and experiments, where appropriate</li> <li>• production of 3-D objects to specification, in particular, accuracy and consistency of multiple forms and/or critical functionality of complex items</li> <li>• production of complex or multiple objects which require a range of silversmithing techniques.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Complex pieces</b>	Complex pieces may include: <ul style="list-style-type: none"> <li>• tea or coffee service</li> <li>• cutlery set</li> <li>• ecclesiastical pieces</li> <li>• decorative boxes</li> <li>• trophies</li> </ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"> <li>• supervisor</li> <li>• manager</li> <li>• trainer</li> <li>• mentor</li> <li>• teacher</li> <li>• team member</li> <li>• client</li> </ul>
<b>Silversmithing</b>	Silversmithing may include: <ul style="list-style-type: none"> <li>• maquette production</li> <li>• sinking</li> <li>• crimping</li> <li>• raising</li> <li>• planishing</li> <li>• spinning</li> <li>• forging</li> <li>• hinge making</li> <li>• fabricating</li> <li>• forming</li> </ul>
<b>Surface finishing techniques</b>	Surface finishing techniques may include:

	<ul style="list-style-type: none"> <li>• electroplating</li> <li>• planishing</li> <li>• patination</li> <li>• polishing</li> <li>• burnishing</li> <li>• heat treating</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements may relate to:</p> <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> <li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li> <li>• excessive energy and water use</li> <li>• excessive noise</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>

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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

# **MEM19053A Create complex findings and mechanisms for jewellery items**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design and create jewellery, which includes complex findings and mechanisms. It includes assessing the application of the design brief in the final outcome.

## **Application of the Unit**

This unit applies to the production of functional and decorative jewellery, by a jeweller, that incorporates complex findings and mechanisms. Applications may include catches, clips, fittings and spring-loaded mechanisms that require and employ complex production techniques.

**Band A**

**Unit Weight 4**

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM19017B      Fabricate jewellery items

MEM19005B      Produce three-dimensional precision items

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Design and develop a concept from a design brief | 1.1 Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area |
|   |  | 1.2 Determine requirements from the design brief, research and discussions with appropriate personnel, if required                             |
|   |  | 1.3 Evaluate relevant research information, references and resources to the design process   |
|   |  | 1.4 Record concept development through a range of drawings, notations and design options   |
|   |  | 1.5 Prepare production plans for selected design solution and refine design, as appropriate.   |
|   |  | 1.6 Produce a model or maquette of the selected design   |
|   |  | 1.7 Determine and obtain resources and equipment to undertake the task   |
| 2 | Produce complex findings and mechanisms          | 2.1 Implement OHS requirements for carrying out the work   |
|   |  | 2.2 Determine appropriate jewellery techniques and equipment through testing and experimenting, if required                                    |
|   |  | 2.3 Select and apply jewellery techniques and processes to produce the item  |
|   |  | 2.4 Determine finding and mechanism most suitable for the design and functionality of the jewellery item                                       |
|   |  | 2.5 Produce and attach finding and mechanism to the item   |



- |   |  |  |
|---|--|--|
|   | 2.6  | Apply relevant surface finishing techniques to the item and prepare for presentation to the client   |
|   | 2.7  | Apply materials and process knowledge to identify and address production problems or inconsistencies |
| 3 | Evaluate object for meeting the design brief |  |
|   | 3.1  | Implement OHS requirements for finishing the work  |
|   | 3.2  | Test object for function against the design brief, if required                                       |
|   | 3.3  | Evaluate and document design processes   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- researching information
- sketching and interpreting drawings
- generating ideas and concepts
- working with a wide range of materials and techniques
- using relevant tools and equipment for producing objects
- preparing and maintaining jewellery tools and equipment (e.g. hammers, stakes, files and vices)
- working effectively with others
- communicating effectively

### Required knowledge

Required knowledge includes:

- concept development techniques
- purpose, function and maintenance of jewellery equipment
- techniques/manufacturing methods for jewellery production
- function and application of jewellery findings and mechanisms
- soldering and fusing techniques for jewellery
- binding and locating techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to produce jewellery items, which include complex findings and mechanisms, according to a design brief.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement OHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate the creation and production of jewellery items on more than one occasion and in different contexts. This includes: <ul style="list-style-type: none"> <li>• development of a sketchbook of drawings and notations that record: <ul style="list-style-type: none"> <li>• ideas and design options generated</li> <li>• concept development</li> <li>• relevant research</li> <li>• plans for production solutions</li> </ul> </li> <li>• production of tests and experiments, where appropriate</li> <li>• production of jewellery items to specification, which include complex findings and mechanisms, that function appropriately on application.</li> </ul> </li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>

Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>manager</li> <li>trainer</li> <li>mentor</li> <li>teacher</li> <li>team member</li> <li>client</li> </ul>
<b>Complex findings and mechanisms</b>	<b>Complex findings and mechanisms may include:</b>

	<ul style="list-style-type: none"><li>• catches for bracelets</li><li>• catches for necklets</li><li>• removable pearl enhancers or pendants</li><li>• sliding brooch fittings and safety locks</li><li>• threaded or hinged earring clips</li><li>• spring-loaded mechanisms</li><li>• multi-functional jewellery items</li></ul>
<b>Jewellery production</b>	Jewellery production may include: <ul style="list-style-type: none"><li>• maquette production</li><li>• soldering</li><li>• fusing</li><li>• crimping</li><li>• folding</li><li>• forging</li><li>• hinge making</li><li>• fabricating</li><li>• forming</li></ul>
<b>Surface finishing techniques</b>	Surface finishing techniques may include: <ul style="list-style-type: none"><li>• electroplating</li><li>• planishing</li><li>• patination</li><li>• polishing</li><li>• burnishing</li><li>• heat treating</li></ul>
<b>OHS requirements</b>	OHS requirements may include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Environmental requirements</b>	Environmental requirements may relate to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>

<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li></ul>
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## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

# MEM19054A Fabricate platinum jewellery items

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to design and create platinum jewellery objects applying a range of jewellery techniques. It includes assessing the application of the design brief in the final outcome.

## Application of the Unit

This unit applies to work conducted in enterprises which produce platinum jewellery items. It requires the application of production processes, such as fusing and soldering, use of OHS equipment and practices, and emery and finishing operations, in a manner that addresses the specialised needs and conditions relevant to working with platinum.

**Band A**

**Unit Weight 4**

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Design and develop a concept from a design brief	1.1	Identify and implement occupational health and safety (OHS) and environmental requirements for carrying out the work and for the work area
		1.2	Determine requirements from the design brief, research and discussions with appropriate personnel, if required
		1.3	Evaluate relevant research information, references and resources to the design process are evaluated
		1.4	Record concept development through a range of drawings, notations and design options
		1.5	Prepare production plans for selected design solution and refine design, as appropriate
		1.6	Determine and obtain resources and equipment to undertake the task
2	Join platinum items using fusing techniques	2.1	Implement OHS requirements for carrying out the work
		2.2	Determine appropriate jewellery techniques and equipment through testing and experimenting, if required
		2.3	Identify properties, visual and working characteristics, and safety considerations of platinum
		2.4	Determine suitability of using platinum in a range of jewellery items
		2.5	Select and apply fusing techniques and processes to commence production of a platinum item
3	Apply soldering techniques	3.1	Determine the soldering sequence that is required for production
		3.2	Select and apply the appropriate solders to produce the platinum item

## 3.10

- |   |  |     |  |
|---|--|-----|--|
| 4 | Construct and finish platinum items          | 4.1 | Select and apply suitable jewellery techniques in constructing the item                              |
|   |  | 4.2 | Apply emery operations and surface finishing techniques which are specific to platinum items         |
|   |  | 4.3 | Apply materials and process knowledge to identify and address production problems or inconsistencies |
|   |  |     |  |
| 5 | Evaluate object for meeting the design brief | 5.1 | Implement OHS requirements for finishing the work  |
|   |  | 5.2 | Test object for function against the design brief, if required                                       |
|   |  | 5.3 | Evaluate and document design processes   |
|   |  | 5.4 | Clean up and maintain production environment   |
|   |  | 5.5 | Apply appropriate control measures to hazardous substances according to environmental requirements   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- researching information
- sketching and interpreting drawings
- generating ideas and concepts
- working with platinum as a major component material
- applying OHS requirements for working with platinum
- applying fusing and soldering techniques for platinum
- using relevant tools and equipment for producing objects
- preparing and maintaining jewellery tools and equipment (e.g. hammers, stakes, files and vices)
- working effectively with others



- communicating effectively

## Required knowledge

Required knowledge includes:

- concept development techniques
- purpose, function and maintenance of jewellery equipment
- characteristics and chemical properties of platinum
- OHS considerations and requirements when working with platinum
- emery requirements for platinum
- pre-polish and finishing options suitable for platinum items
- acids used in platinum work
- chemical and visual differences of platinum with other commonly used metals
- contamination risks for platinum
- heating and cooling techniques for platinum
- techniques/manufacturing methods and tools for platinum production
- fusing and soldering techniques for platinum jewellery
- surface finishing aspects specific to platinum jewellery production
- binding and locating techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to apply specific safety requirements for working with platinum and apply jewellery production and surface techniques relevant to this material.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement OHS workplace procedures and practices, including the use of risk control measures specific to platinum production</li><li>• demonstrate the creation and production of platinum jewellery items on more than one occasion and in different contexts. This includes:<ul style="list-style-type: none"><li>• development of a sketchbook of drawings and notations that record:</li></ul></li></ul>

	<ul style="list-style-type: none"> <li>• ideas and design options generated</li> <li>• concept development</li> <li>• relevant research</li> <li>• plans for production solutions</li> <li>• production of tests and experiments, where appropriate</li> <li>• fusing and soldering techniques for platinum.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• manager</li> <li>• trainer</li> <li>• mentor</li> <li>• teacher</li> <li>• team member</li> <li>• client</li> </ul>
<b>Jewellery production</b>	<p>Production may include:</p> <ul style="list-style-type: none"> <li>• soldering</li> <li>• fusing</li> <li>• crimping</li> <li>• folding</li> <li>• forging</li> <li>• hinge making</li> <li>• fabricating</li> <li>• forming</li> </ul>
<b>Surface finishing techniques</b>	<p>Surface finishing techniques may include:</p> <ul style="list-style-type: none"> <li>• electroplating</li> <li>• emery finishes</li> <li>• planishing</li> <li>• polishing</li> <li>• burnishing</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• personal protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>

	<ul style="list-style-type: none"><li>• use of welding goggles</li><li>• safe use of chemicals</li></ul>
<b>Environmental requirements</b>	Environmental requirements may relate to: <ul style="list-style-type: none"><li>• liquid waste</li><li>• solid waste</li><li>• gas, fume, vapour, smoke emissions, including fugitive emissions, and dust</li><li>• excessive energy and water use</li><li>• excessive noise</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li></ul>

## Unit Sector(s)

Jewellery

## Custom Content Section

Not applicable.

## MEM20001A Produce keys

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers producing and duplicating keys for mechanical locking devices and systems - by hand, code and duplicating machine, computer code machines and read/write transponder programming.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to production and duplication of keys in a store/workshop, mobile workshop or on-site. It applies to the production of keys across a range of locksmithing areas, including automotive, domestic, commercial, security containers and ancillaries.</p> <p>Key tasks are identifying blank type, obtaining blank, selecting cutting method, preparing tools and equipment, cutting/duplicating keys, checking finished product.</p> <p>If electronically stored data is accessed and recorded (where program knowledge and judgement is not required), Unit MEM16006A (Organise and communicate information) should also be selected.</p> <p>This unit applies to identification of transponder keys and programming read/write transponder keys only. Where other programming of high-security transponders is required, Unit MEM20013A (Service automotive transponder systems) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>	
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## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify requirements for key production	1.1.Appropriate method for cutting/duplicating is selected according to key type and system, and other applicable factors. 1.2.Requirements for key production are identified from instructions, documentation and existing samples. 1.3.Signatories are confirmed.
2. Prepare materials and equipment	2.1.Appropriate tools and equipment are selected. 2.2.Correct key blank is selected for the given application. 2.3.Equipment and accessories are set up correctly for cutting/duplicating.

ELEMENT	PERFORMANCE CRITERIA
3. Produce and duplicate keys	3.1.Key correctly fits and operates lock. 3.2.Key dimensions meet manufacturer specifications. 3.3.Hand tools and equipment are used safely and correctly. 3.4.Key is finished according to standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting appropriate cutting/duplicating method
- using and interpreting conversion charts, reference books, and samples to identify blank requirements
- accessing and using computer and book code programs
- measuring key dimensions
- identifying key types and features
- identifying faults in samples
- selecting tools and equipment
- setting up and safely using cutting and duplicating equipment
- testing and adjusting key operation
- checking calibration
- key finishing

#### Required knowledge

Look for evidence that confirms knowledge of:

- different techniques for cutting and duplicating
- tools and equipment for hand and machine cutting
- key systems and blanks
- spacings, depths, angles, shapes and other measurements relevant to cutting keys
- terminology for key production
- workplace method for confirming signatory to key order
- tools, equipment and accessories for cutting keys by hand and machine

**REQUIRED SKILLS AND KNOWLEDGE**

- key blank storage and classification systems
- housekeeping procedures
- safe operation of equipment and safe work practices
- identification marking procedures
- key storage and packaging procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to produce and duplicate various keys across a range of locksmithing areas.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing keys, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct



**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate method for cutting/duplicating</b>	Hand, machine, computer and book code equipment, programming of read/write transponders
<b>Key types</b>	Inline pin tumbler, single and double sided wafer, 2 and 4 track, lever (pin, pipe, mortice, flat steel, double bitted), warded, pre-cut, rotating pin, rotating disc, axial pin (dimple), tubular, cruciform
<b>Key systems</b>	Restricted, semi-restricted and non-restricted system numbers, manufacturer restricted, factory restricted, locksmith restricted/managed, association restricted
<b>Requirements for key production</b>	Specific client requirements and quantities, completion times and dates, job requirements and tasks, signature authorities, OHS requirements, company requirements, compliance with relevant

<b>RANGE STATEMENT</b>	
	manufacturer requirements, warranties and service information
<b>Documentation</b>	Materials used, identified faults, warranties and recommendations, costs
<b>Tools and equipment</b>	<ul style="list-style-type: none"> <li>Manual and computerised code machines, milling machines, tubular machines, duplicating machines, crimpers, hand files, bridge support.</li> <li>Measuring equipment includes standard gauges and vernier callipers</li> </ul>
<b>Safely and correctly</b>	<ul style="list-style-type: none"> <li>OHS policies and procedures include hazardous and risk assessment mechanisms, implementation of safety regulations, safety training, safety, systems incorporating use of protective equipment, use of codes of practice, emergency procedures, first aid</li> <li>Safety and personal protective equipment includes safety glasses, support devices and rests, guarding</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Locksmithing
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## MEM20002A Assemble and test lock mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers manually assembling key mechanisms.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to assembly operations that are essentially manual in nature and require the application of accepted locksmithing principles and practices. Assembly activities typically involve built-to-order work and/or low volume and/or complex assemblies and/or long assembly timeframes.</p> <p>This unit could apply to assembly of cylinders within a masterkey system and individually keyed cylinders.</p> <p>Work may involve manual adjustments of locking assemblies to correct clearances and alignments to predetermined standards of quality and safety.</p> <p>Applications of this unit may also require varying levels of measurement competencies. Where this is the case, Unit MEM12023A (Perform engineering measurements) or Unit MEM12003B (Perform precision mechanical measurement) should also be selected as appropriate.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM20001A	Produce keys

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify key mechanism features and assembly requirements	1.1.Assembly specifications are identified from instructions and documentation. 1.2.Appropriate authorisations are obtained, signatures checked and order confirmed. 1.3.Appropriate assembly sequence/method is planned in accordance with instructions and manufacturer documentation.
2. Prepare to assemble lock mechanisms	2.1.Lock mechanisms are disassembled, if necessary. 2.2.Components and parts are compiled in accordance with assembly specifications. 2.3.Tools, equipment and materials are selected to suit job requirements.

ELEMENT	PERFORMANCE CRITERIA
	<p>2.4. Work area is prepared and components are arranged in accordance with organisational procedures and selected assembly technique.</p> <p>2.5. Defective or faulty parts are identified and processed according to organisational procedures.</p>
3. Assemble lock mechanisms	<p>3.1. Locksmithing techniques and principles are applied appropriate to assembly activity.</p> <p>3.2. Records/data are maintained or processed in accordance with organisational requirements.</p> <p>3.3. Component parts are fitted to ensure correct positioning and conformance with specifications.</p> <p>3.4. Locking mechanism is correctly marked/ tagged/ identified as appropriate in accordance with organisational procedure.</p> <p>3.5. Components and/or assembly are handled and stored in a manner least likely to cause damage and in accordance with organisational procedure.</p>
4. Identify the combination of an assembled mechanism	<p>4.1. The lock mechanism and construction is correctly identified using appropriate method.</p> <p>4.2. Lock mechanism is decoded (internal locking components).</p>
5. Check finished products	<p>5.1. Operation of the lock mechanism and key is checked for conformance to specifications.</p> <p>5.2. Faults in lock mechanism or key operation are identified and rectified.</p>
6. Mark, package and label products	<p>6.1. Products are stamped with correct door and key reference information in accordance with organisational procedures.</p> <p>6.2. Stamping equipment is selected and used correctly.</p> <p>6.3. Products are grouped, packaged and labelled for installation in accordance with organisational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- checking components/parts against key schedule/job sheet, assembly list or equivalent instructions
- planning assembly sequence
- decoding key mechanisms

### Required knowledge

Look for evidence that confirms knowledge of:

- types of mechanical locking devices
- information on handwritten and computer generated pinning charts, key and door schedules, hardware chart, mechanical locking devices, mechanisms and components
- the importance of obtaining authorisations
- the difference between levers and key blanks
- fitting requirements and sequence of assembly
- tools, equipment and materials for assembling lock mechanisms
- door and key reference information and stamping methods

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to assemble locking devices and produce keys from locks. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assembling locking devices, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



<b>RANGE STATEMENT</b>	
<b>Assembly specifications</b>	Required components and parts, door handing, timeframe for completion, keying instructions and fitting requirements
<b>Documentation</b>	Door and key schedules, job sheet, pinning charts, hardware charts, manufacturer documentation
<b>Lock mechanisms</b>	Pin and disc tumbler cylinders, lever and warded locks
<b>Components and parts</b>	Wafers, springs, key blanks, plugs, levers, housings, pins, cams and screws, circlips and tails
<b>Tools and equipment</b>	Jigs, followers, tweezers, screwdrivers, circlip pliers, files, wire wheel
<b>Materials</b>	Graphite, Teflon and silicone based lubricants
<b>Reference information</b>	System member, rank, key issue, dealer identification
<b>Stamping equipment</b>	Dedicated stamping machine, hand stamps, stamping block

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Locksmithing
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## MEM20003A Install and upgrade locks and hardware

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing and upgrading locks/locking systems and lock furniture, including providing advice on installation and upgrade requirements and instructing clients on the use of the product.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies across commercial, industrial and domestic applications. It requires the ability to plan and administer the installation process from start to completion. Work would be carried out mainly off-site, and to organisational, industry and legislative requirements.</p> <p>Fitting of door control devices is covered in Unit MEM20005A (Install and maintain door control devices/systems)</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish installation and upgrade requirements	<p>1.1. Customer requirements and work order/instructions are identified and clarified with appropriate person/s as required in accordance with organisational requirements.</p> <p>1.2. Customer is advised of products, product options and possible upgrade options in accordance with organisational and customer requirements.</p> <p>1.3. Installation procedure is established in accordance with work order and with minimal disruption to customer, services or normal work routines.</p>
2. Organise and prepare installation	2.1. Appropriate and serviceable tools, equipment, and materials are selected and obtained in accordance with organisational requirements, procedures and

ELEMENT	PERFORMANCE CRITERIA
	<p>fitting instructions.</p> <p>2.2.A safe work site is established and maintained in accordance with OHS, legislative and organisational requirements.</p> <p>2.3.Suitable safety and personal protective equipment is selected and used in accordance with OHS, legislative and organisational requirements.</p> <p>2.4.Access to site and specific site requirements are established, and appropriate arrangements made in accordance with client and organisational requirements.</p>
3. Install and upgrade locks and hardware	<p>3.1.Installation location is prepared, measured and marked out as appropriate.</p> <p>3.2.Lock and hardware are fitted in accordance with manufacturer specifications and organisational requirements.</p> <p>3.3.Lock and hardware function is checked for correct functioning and operational problems are rectified.</p> <p>3.4.Work is carried out using safe work procedures and practices and in accordance with applicable legislation, codes, regulations and standards.</p> <p>3.5.Problems affecting the installation are identified and variations to installation are discussed and resolved with appropriate persons.</p>
4. Complete the installation	<p>4.1.Work site is cleaned and left in presentable condition in accordance with original presentation, client requirements, industry standards and organisational requirements.</p> <p>4.2.Final inspections are undertaken to ensure installation conforms with industry, legislative and order requirements.</p> <p>4.3.Client is notified of job completion and client acceptance is obtained in accordance with organisational procedures.</p> <p>4.4.Client is instructed on use of product in accordance with organisational requirements and manufacturer specifications.</p> <p>4.5.Relevant documentation is accurately completed and processed in accordance with industry, legislative and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- measuring and marking out with tape measures, rules, squares and templates
- identify existing fixtures and fittings (if any) including type and quality of construction
- establishing customer requirements such as location, product type/colour/function, compatibility with existing hardware
- communicating product information
- interpreting fitting instructions/templates/terminology
- planning stages/steps for installation or upgrade and suitable timeframe for installation
- checking tools for serviceability
- selecting appropriate tools for the type of products, materials and conditions
- identifying and assessing hazards
- using safety and personal protective equipment
- safely using tools and equipment
- drilling, filing, fixing
- applying safe work practices
- assessing the potential for unforeseen problems and incidents to affect the installation
- testing and confirming function of locks and hardware
- completing and processing documentation

#### Required knowledge

Look for evidence that confirms knowledge of:

- utility and application of locks/hardware/accessories
- fixtures (doors, frames, windows etc.) and their type of construction, such as foam fill, hollow, clad, steel, aluminium and other materials
- types and functions of locks, hardware and accessories to suit different fixtures and materials
- factors for determining customer requirements
- factors affecting suitable options including intended use, cost, compatibility with existing hardware
- installation procedures for locks/hardware/accessories
- terminology relating to lock products and installation
- tools and equipment for installing locks, hardware and lock furniture

## REQUIRED SKILLS AND KNOWLEDGE

- use of specialised tools, such as morticers, routers, jigs, cherry centre
- materials, parts and components for installation of locks and lock furniture
- hazards and risks to installer, client and public
- applicable legislation, local regulations
- safety and emergency measures and safe work practices to avoid or minimise potential and actual hazards
- individual responsibilities and duty of care
- types and uses of personal protective equipment
- access and installation factors, such as site safety issues, night access, disruption to client work routines, installation environment, building codes
- procedures for measuring and marking lock and lock furniture positions
- installation procedures for locks and lock furniture
- effects of incorrect installation
- common installation problems
- troubleshooting and lock testing methods
- potential installation problems and incidents, including breakdowns, environmental, physical, time and cost restrictions, product supply problems
- strategies for resolving problems and incidents
- procedures and industry standards for site clean-up
- organisational requirements for final inspection
- organisational requirements for client acceptance
- manufacturer specifications, uses, limitations and warranties for relevant product/s
- procedures to complete and process relevant documentation, including installation details, costings, materials used, records of faults and damage, installation problems and factors, testing and inspection results
- environmentally safe disposal procedures for packaging and other waste
- procedures for client notification and acceptance of job completion

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to install and upgrade locks and hardware. Competency in this unit cannot be claimed until all

<b>EVIDENCE GUIDE</b>	
	prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing and upgrading locks and hardware, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Customer requirements</b>	May relate to product type, function and capabilities, access issues, installation locations and positions, upgrade information, service and maintenance requirements, product operation and warranty information, costings
<b>Work order/instructions</b>	Schedules, timeframes, access and site information, products, installation and upgrade requirements, specific client requests, materials, costings, warranties and service information, legislation, codes and regulatory requirements, OHS factors and requirements
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use, organisational processes and procedures, documentation processes, product and process training
<b>Tools, equipment and other materials</b>	Hand tools, power tools and accessories, fixing tools, special-purpose equipment, lubricants, adhesives and sealants, cleaning materials, wire and cable, vacuum, door&window and frame materials e.g. aluminium, timber, MDF
<b>Safety and personal protective equipment</b>	Night hats, signs, barriers, masks/goggles/safety glasses, earmuffs/plugs, vests, hard hats, gloves, knee pads, safety boots, warning signs and tapes, fire extinguisher, first aid kit
<b>Locks and hardware</b>	Cylinder nightlatches and deadlocks, lever and cylinder mortice locks, tubular deadbolts, key in knob, key in lever, tie bolts, door control devices, exit devices, lockable bolts, peep holes, window locks
<b>Safe work procedures and</b>	Risk identification and assessment, non

<b>RANGE STATEMENT</b>	
<b>practices</b>	compliance with building codes and regulations, safety practices and regulations, safe use of tools and equipment, individual responsibilities and obligations, safety training and procedures, emergency and first aid procedures, working in confined spaces, use of personal protective equipment, industry standards and codes of practice, dust and fibres in relation to MDF and possible asbestos
<b>Legislation, codes, regulations and standards</b>	Industry licensing, industry codes of practice, privacy laws, Australian standards, building codes and those of other regulatory bodies, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Locksmithing
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## MEM20004A Gain entry

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers gaining entry and straightforward return to service of general types of mechanical locks.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to gaining entry into commercial and domestic locks. The basis for entry includes lockout (keys inside), lost keys (rekeys) and malfunction. Applications include locks for doors and windows.</p> <p>It requires an ability to safely gain straightforward entry to mechanical locking devices, taking into account factors that ensure conformance to specifications and operational performance.</p> <p>These include locksmithing principles, ethics, techniques, procedures and safe work practices.</p> <p>Where specialised skills are required to gain entry and to reinstate both mechanical and electronic locking systems in automotive or fire and security containers, the appropriate units should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM20001A	Produce keys
	MEM20002A	Assemble and test lock mechanisms
	MEM20003A	Install and upgrade locks and hardware

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish entry requirements, authorisation and ownership	<p>1.1.Reason for entry, nature and urgency of problem is established.</p> <p>1.2.Evidence relating to ownership and/or legal possession and authenticity of request is verified.</p> <p>1.3.Own representation and authorisation is given.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.4.Construction and mechanism information, including lock type, manufacturer, model, date, restrictions and limitations is identified.</p> <p>1.5.Entry requirements and process are confirmed with customer.</p>
2. Gain entry to mechanical locking system	<p>2.1.Appropriate tools, equipment and entry methods are selected for the given mechanism, problem, conditions, customer and organisational requirements.</p> <p>2.2.A safe and secure working environment is established according to industry, organisational and legislative requirements.</p> <p>2.3.Selected tools are used to gain entry with minimal damage using appropriate industry practices.</p> <p>2.4.Limitations and problems are identified and advice/assistance is sought as appropriate.</p> <p>2.5.Locks and components are replaced, if necessary.</p> <p>2.6.Keys are manufactured as required.</p>
3. Finalise and document entry process	<p>3.1.Functioning of locking system is checked and adjusted as necessary for correct operation.</p> <p>3.2.Operational problems are identified for further service or repair.</p> <p>3.3.Temporary or replacement lock is fitted, if necessary.</p> <p>3.4.Job details and recommendations for any further action are given to customer according to organisational procedures.</p> <p>3.5.Customer is instructed on use of new components, if necessary.</p> <p>3.6.Completed documentation is accurate and is processed in accordance with legislative, industry and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- handpicking
- impressioning
- diagnosing problems
- relating to customers
- questioning
- manipulating locks/latches (bypassing cylinder)

### Required knowledge

Look for evidence that confirms knowledge of:

- products
- product identification
- methods of gaining access to mechanical locks
- tools and equipment for gaining access to mechanical locks
- operation and assembly of mechanical locks
- using catalogues and resources
- reading assembly drawings
- procedures to establish legal possession
- legal obligations and ethical requirements
- procedures to deal with fraudulent requests
- requirements and procedures for fitting temporary locks
- workplace hazards and risk minimisation

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to gain entry to a range of mechanical locks across a range of applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gaining entry or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different

<b>RANGE STATEMENT</b>	
work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Evidence for legal possession</b>	Photo identification, letters of authority, proof of ownership papers
<b>Lock type</b>	Pin tumbler (4.5.6.7 pin), wafer - E.G. L + F, lever, mechanical digital, exposed wheel combination, tubular locks
<b>Tools and equipment</b>	Specialised files, impression tools, pick gun, hand tools relating to gaining access  Picks: curved, rake, hooks, tension wrenches (turning), lever lock picks, custom tools, tubular lock picks, scope
<b>Entry methods</b>	Pick, impressioning, reading, bypass, manipulation, drilling
<b>Keys</b>	Blank recognition, keys to code, keys to sample, use of key machines, use of computer and book code programs
<b>Documentation</b>	Disclaimer documents, receipt/invoice, job sheets

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Locksmithing
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## MEM20005A Install and maintain door control devices/systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting, installing, fault finding and adjusting a range of door control devices and door control systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the correct selection and installation of mechanical door control devices and door control systems in commercial, industrial and domestic environments.</p> <p>It requires the ability to identify maintenance requirements, use safe and efficient work practices to inspect, service and repair mechanical door control devices, maintain a hazard-free work area and accurately document and maintain information systems.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM18001C	Use hand tools

<b>Prerequisite units</b>		
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for installation and service	<p>1.1. Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements.</p> <p>1.2. Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications.</p> <p>1.3. Faulty or unsafe tools are identified and segregated for repair or replacement in accordance with organisational procedures.</p> <p>1.4. Potential and existing risks and hazards associated with maintenance activities are identified and controlled in accordance with OHS policies and procedures and organisational requirements.</p> <p>1.5. Suitable personal protective equipment is selected</p>

ELEMENT	PERFORMANCE CRITERIA
	and maintained in accordance with OHS and organisational requirements.
2. Install door control devices/systems	<p>2.1.All work is conducted using safe operating practices in accordance with OHS and organisational requirements.</p> <p>2.2.The appropriate door control device/systems are selected for the given door type and specifications.</p> <p>2.3.Door control devices/systems are installed in accordance with manufacturers' specifications, work order and OHS requirements legislative and organisational requirements.</p> <p>2.4.Door control devices/systems are checked for correct operation and adjusted as necessary.</p>
3. Service door control device	<p>3.1.Checks are conducted on door control devices/systems and/or components to identify any damage, friction or sticking in accordance with manufacturers' specifications.</p> <p>3.2.Assessment of viability for continued operation or replacement of door control device.</p> <p>3.3.Door control devices/systems and/or components are adjusted in accordance with manufacturers' specifications, work order and OHS requirements legislative and organisational requirements.</p>
4. Complete installation or service	<p>4.1.Notification of work completion is made to appropriate person(s) in accordance with organisational procedures.</p> <p>4.2.Documentation is promptly and accurately completed and processed in accordance with industry, legislative and organisational requirements.</p> <p>4.3.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>4.4.Malfunctions, faults, wear or damage to tools is reported for repair or replacement in accordance with organisational policy and procedures.</p> <p>4.5.Waste from service and repair activities is collected, treated and disposed or recycled in accordance with organisational and environmental requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating in a clear and concise manner
- using appropriate tools and equipment
- lubricating mechanical locks and locking systems
- demonstrating basic logic and lateral thinking processes
- disassembling/reassembling mechanical locks/locking systems
- identifying faults
- reading and interpreting specifications, charts and diagrams
- methodically organising and prioritising work tasks
- solving routine problems
- working in confined spaces
- accurately estimating materials, tools and equipment requirements
- applying safe and environmentally aware workplace practices

#### Required knowledge

Look for evidence that confirms knowledge of:

- types, functions and specifications of door control devices/systems
- correct selection of door control devices
- operational principles of door control devices/systems
- common door control devices/systems faults
- maintenance requirements of door control devices/systems
- tests to confirm door control devices/systems operation
- procedures to disassemble/reassemble
- technical terminology
- types of doors and windows and mechanical system applications
- maintenance risks and hazards
- working in confined space procedures
- duty of care

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to install and maintain door control devices/systems across a range of areas. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing and maintaining door control systems/devices, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Work order**

Work schedules, completion dates, job requirements and tasks, specific client requirements, access to site and specific site requirements, resource requirements, OHS requirements, compliance with relevant legislation, budget allocations, warranties and service information

**Appropriate person(s)**

Installer, sub contractor, technician, supervisor, manager, director, client

**Organisational requirements**

Legal and organisational operational policies and procedures, operations manuals, induction and training materials, insurance policy agreements, client and organisational confidentiality requirements, organisational goals/objectives/plans/systems/ processes, employer and employee rights and responsibilities, own role, responsibility and delegation, quality and continuous improvement processes and standards, client service standards, defined resource parameters, OHS policies/procedures/programs, emergency and evacuation procedures, duty of care, code of conduct, code of ethics, access and equity policy, principles and practice, records and information systems and processes, communication channels and reporting procedures

<b>RANGE STATEMENT</b>	
<b>Tools and equipment</b>	Hand tools, fixing tools, strippers, router, file, drill, power saw, spirit level, soldering iron, welder, ladder, hoist, drop sheet, batteries, master key plans, personal protective equipment, communications equipment
<b>Materials</b>	Solder, insulation tape, springs, pins, graphite powder, oil, silicon, dry lube, grease, lockase, glue, paint, patch materials, electronic components, cleaning compounds, key blanks
<b>Risks and hazards</b>	Non-compliance with building codes and regulations, exposed electrical wiring, manual handling, exposure to asbestos, dust, noise, live power, vermin, water, glass fibre, building debris, natural and other gas build-up
<b>Maintenance</b>	Cleaning, inspection, lubrication, routine repairs, identification of worn parts, confirming operation, adjustments, key cutting, replacement of worn parts
<b>OHS policies and procedures</b>	Hazardous and risk assessment mechanisms, implementation of safety regulations, safety training, safety systems incorporating - work clearance procedures, isolation procedures, gas and vapour, monitoring/testing procedures, use of protective equipment and clothing, use of codes of practice
<b>Personal protective clothing and equipment</b>	Masks, safety glasses, head protection, ear muffs, safety boots, knee pads, gloves, warning signs and tapes, first aid kit
<b>Door control devices/systems</b>	Surface mounted door closers, semi concealed door closers, concealed closers, semi automatic/automatic door control devices, exit devices
<b>Safe operating practices</b>	Working safely around electrical wiring, cables and overhead power lines, working safely around tools and equipment, hazard recognition, emergency procedures, awareness of electrical hazards, following confined spaces procedures, administering first aid



**RANGE STATEMENT**

<b>Applicable legislation, codes and national standards</b>	Compliance with Australian building codes and regulations, compliance with Australian Communications Authority (ACA) cabling standards, EPA noise control regulations, relevant Commonwealth/State/Territory legislation which affect organisational operation - OHS and safe work practices, environmental issues, equal employment opportunity, industrial relations, anti-discrimination and diversity, licensing arrangements, Australian standards, quality assurance and certification requirements, relevant industry codes of practice, trade practices, award and enterprise agreements, privacy requirements and privacy related legislation
<b>Documentation</b>	Completion of work log, mechanical lock/locking system problems/faults, warranty conditions and allowances, recommendation for repairs, operational checks and maintenance conducted, testing and commissioning results, parts and components replaced, materials used, recommendations for future operation and maintenance, costings

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Locksmithing
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## MEM20006A Maintain and service mechanical locking devices

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers carrying out maintenance of a range of mechanical locks and locking systems. This unit has been modified from Unit PRSTS311 Maintain and repair mechanical lock/locking system in the (PRS03) Asset Security Training Package endorsed 19/03/2003.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to maintenance of a range of mechanical locks and locking systems in commercial, industrial and domestic environments.</p> <p>It requires the ability to identify maintenance requirements, use safe and efficient work practices to inspect, service and repair mechanical locks/locking systems, maintain a hazard-free work area and accurately document and maintain information systems.</p> <p>For maintenance and servicing of automotive locks, Unit MEM20012A (Service and repair mechanical automotive locking systems) or MEM20013A (Service automotive transponder systems) should be selected.</p> <p>For maintenance and servicing of safes, Unit MEM20011A (Service and repair fire and security containers) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for maintenance	<p>1.1. Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements.</p> <p>1.2. Mechanical locks/locking systems to be inspected, serviced and/or repaired are identified and confirmed in accordance with work order.</p> <p>1.3. Tools, equipment and materials are selected</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>appropriate to job requirements and checked for operational effectiveness in accordance with manufacturers' specifications.</p> <p>1.4. Faulty or unsafe tools are identified and segregated for repair or replacement in accordance with organisational procedures.</p> <p>1.5. Potential and existing risks and hazards associated with maintenance activities are identified and controlled in accordance with OHS policies and procedures and organisational requirements.</p> <p>1.6. Suitable personal protective equipment is selected and maintained in accordance with OHS and organisational requirements.</p>
2. Maintain mechanical lock/locking system	<p>2.1. All work is conducted using safe operating practices in accordance with OHS and organisational requirements.</p> <p>2.2. Mechanical locks/locking systems identified for maintenance are accessed with minimal disruption to client, services or normal work routines.</p> <p>2.3. Checks are conducted on mechanical locks/locking systems and/or components to identify any damage, friction or sticking in accordance with manufacturers' specifications.</p> <p>2.4. Mechanical locks/locking systems and/or components are serviced and repaired in accordance with manufacturers' specifications, work order and OHS requirements.</p> <p>2.5. Worn keys are identified and replaced as required to ensure effective operational capability in accordance with work order, legislative and organisational requirements.</p> <p>2.6. Complex faults or repair requirements outside area of responsibility or competence are reported to appropriate person(s) for specialist advice in accordance with organisational procedures.</p>
3. Complete maintenance	<p>3.1. Serviced and/or repaired mechanical locks/locking systems are reassembled and checked for correct operation and serviceability in accordance with manufacturers' specifications and OHS requirements.</p> <p>3.2. Notification of work completion is made to appropriate person(s) in accordance with organisational procedures.</p> <p>3.3. Documentation is promptly and accurately</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>completed and processed in accordance with industry, legislative and organisational requirements.</p> <p>3.4. Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>3.5. Malfunctions, faults, wear or damage to tools are reported for repair or replacement in accordance with organisational policy and procedures.</p> <p>3.6. Waste from service and repair activities is collected, treated and disposed or recycled in accordance with organisational and environmental requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating in a clear and concise manner
- using appropriate tools and equipment
- lubricating mechanical locks and locking systems
- demonstrating basic logic and lateral thinking processes
- disassembling/reassembling mechanical locks/locking systems
- identifying faults
- reading and interpreting specifications, charts and diagrams
- methodically organising and prioritising work tasks
- solving routine problems
- working in confined spaces
- accurately estimating materials, tools and equipment requirements
- applying safe and environmentally aware workplace practices

#### Required knowledge

Look for evidence that confirms knowledge of:

- types, functions and specifications of mechanical locks/locking systems
- operational principles of mechanical locks and locking systems
- common mechanical locking faults

**REQUIRED SKILLS AND KNOWLEDGE**

- maintenance requirements of mechanical locks and locking
- common mechanical lock and locking system faults
- tests to confirm lock operation
- procedures to disassemble/reassemble mechanical locks
- technical terminology
- types of doors and windows and mechanical locking system applications
- maintenance risks and hazards
- working in confined space procedures
- duty of care

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain and service mechanical locking devices across a range of locksmithing areas. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

<b>EVIDENCE GUIDE</b>	
	materials handling, recording and reporting associated with maintaining and servicing mechanical locking devices, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Work order</b>	Work schedules, completion dates, job requirements and tasks, specific client requirements, access to site and specific site requirements, resource requirements, OHS requirements, compliance with relevant legislation, budget allocations, warranties and service information
<b>Appropriate person(s)</b>	Installer, sub contractor, technician, supervisor, manager, director, client



<b>RANGE STATEMENT</b>	
<b>Organisational requirements</b>	Legal and organisational operational policies and procedures, operations manuals, induction and training materials, insurance policy agreements, client and organisational confidentiality requirements, organisational goals/objectives/plans/systems/ processes, employer and employee rights and responsibilities, own role, responsibility and delegation, quality and continuous improvement processes and standards, client service standards, defined resource parameters, OHS policies/procedures/programs, emergency and evacuation procedures, duty of care, code of conduct, code of ethics, access and equity policy, principles and practice, records and information systems and processes, communication channels and reporting procedures
<b>Mechanical locks/locking systems</b>	Nightlatches, deadlocks, lever and cylinder mortice locks, tubular deadbolts, key in knob, key in lever, tie bolts, exit devices, door control devices, lockable bolts, window locks, high security cylinders for commercial applications, exposed wheel combination locks (e.g. briefcases), mechanical digital (e.g. simplex), lockwood digital, tubular locks
<b>Tools and equipment</b>	Hand tools, fixing tools, strippers, router, file, drill, power saw, lockpick, pick gun, spirit level, soldering iron, welder, ladder, hoist, drop sheet, batteries, master key plans, personal protective equipment, communications equipment
<b>Materials</b>	Solder, insulation tape, springs, pins, graphite powder, oil, silicon, dry lube, grease, lockease, glue, paint, patch materials, electronic components, cleaning compounds, key blanks
<b>Risks and hazards</b>	Non-compliance with building codes and regulations, exposed electrical wiring, manual handling, exposure to asbestos, dust, noise, live power, vermin, water, glass fibre, building debris, natural and other gas build-up
<b>OHS policies and procedures</b>	Hazardous and risk assessment mechanisms, implementation of safety regulations, safety training, safety systems incorporating - work

<b>RANGE STATEMENT</b>	
	clearance procedures, isolation procedures, gas and vapour, monitoring/testing procedures, use of protective equipment and clothing, use of codes of practice
<b>Personal protective clothing and equipment</b>	Masks, safety glasses, head protection, ear muffs, safety boots, knee pads, gloves, warning signs and tapes, first aid kit
<b>Safe operating practices</b>	Working safely around electrical wiring, cables and overhead power lines, working safely around tools and equipment, hazard recognition, emergency procedures, awareness of electrical hazards, following confined spaces procedures, administering first aid
<b>Maintenance</b>	Cleaning, inspection, lubrication, routine repairs, identification of worn parts, confirming operation, adjustments, key cutting, replacement of worn parts
<b>Access</b>	Disassembly, use of access code, disablement of system, removal of housing, access token, keys, phone line access
<b>Disruptions</b>	Security, time, access, noise, use of communications equipment, business operations
<b>Applicable legislation, codes and national standards</b>	Compliance with Australian building codes and regulations, compliance with Australian Communications Authority (ACA) cabling standards, EPA noise control regulations, relevant Commonwealth/State/Territory legislation which affect organisational operation - OHS and safe work practices, environmental issues, equal employment opportunity, industrial relations, anti-discrimination and diversity, licensing arrangements, Australian standards, quality assurance and certification requirements, relevant industry codes of practice, trade practices, award and enterprise agreements, privacy requirements and privacy related legislation
<b>Documentation</b>	Completion of work log, mechanical lock/locking system problems/faults, warranty conditions and allowances, recommendation for repairs, operational checks and maintenance conducted, testing/commissioning results, parts/components

**RANGE STATEMENT**

	replaced, materials used, future operation and maintenance recommendations, costings
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Locksmithing
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## MEM20007A Plan and prepare a masterkey system

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers creating a new masterkey system for in-line pin tumbler cylinders up to and including a hierarchical GGMK system and maisonning.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to manually developing a standard (even cut) progression in-line MK system and using a computer masterkeying package.</p> <p>Tools and equipment used would include pen paper, computer.</p> <p>All relevant legislative requirements, policies and procedures and codes of practice are adhered to including hazardous risk recognition and assessment, working safely around tools and equipment, emergency procedures, administering first aid.</p> <p>If a security survey/site assessment is required, then Unit MEM20014A (Perform a site security survey) should also be selected.</p> <p>For cross keying, submasterkeying and selective keying, refer to Unit MEM20008A (Develop and implement a masterkey system).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM20001A	Produce keys
	MEM20002A	Assemble and test lock mechanisms

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess customer requirements	<ul style="list-style-type: none"><li>1.1.Customer needs are discussed and clarified according to organisational procedures.</li><li>1.2.Appropriate levels of security/access are reviewed with respect to customer assets, activities and existing security arrangements.</li><li>1.3.Door and lock schedules and other appropriate documentation are prepared according to organisational procedures.</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.4.Customer requirements are matched to the mechanical possibilities and limitations of masterkey systems.</p> <p>1.5.Options are identified and customer is advised on options and alternatives.</p> <p>1.6.Personal limitations in assessing requirements for key systems and masterkey systems are identified and assistance is sought from appropriate person(s) in accordance with organisational procedures.</p>
2. Design masterkey system	<p>2.1.Keying matrix is developed to customer requirements, allowing for future system expansion and mechanical capabilities of system.</p> <p>2.2.Key codes (progression chart) are produced from mathematical permutations and calculations as per customer requirements.</p> <p>2.3.Key codes are selected from progression chart that maximise system security.</p> <p>2.4.Key cutting and cylinder loading charts are accurately developed.</p> <p>2.5.Incidental masterkeys are identified within progression charts.</p> <p>2.6.Principles of masterkeying are applied in accordance with industry practice and organisational requirements.</p>
3. Finalise system design	<p>3.1.Final system design and keying requirements are reviewed and confirmed with appropriate person(s) in accordance with organisational requirements.</p> <p>3.2.Documentation is accurately prepared and processed and stored in accordance with client, legislative and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

## REQUIRED SKILLS AND KNOWLEDGE

- listening and questioning
- reading architectural plans, floor plans and charts
- applying calculations and formulae within the scope of this unit
- recording information on a floor plan
- developing key matrix
- developing and reading progression charts
- selecting codes from a progression chart that maximise system security
- checking own and others' codes for interchange
- identifying incidental masters in a key system
- selecting groups of codes to form a maisonned cylinder
- creating saving and storing information/documentation related
- using key system

## Required knowledge

Look for evidence that confirms knowledge of:

- record keeping and management
- manufacturers'/Australian/building standards
- product knowledge/limitations
- key matrixes and schedules
- allowances for expansion
- operation and limitations of masterkey systems
- levels of systems (KD, KA, MK, GMK, GGMK)
- door handing
- cylinder types
- criteria for key code selection
- strategies for checking key systems for interchange
- strategies for checking key systems for incidental masters
- principles of maison keying
- strategies for code selection

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to survey and prepare a masterkey system to in-line GMK level. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with surveying and preparing masterkey systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Reviewed</b>	Physically and/or off the plan
<b>Customer requirements</b>	Specific client requirements and quantities, completion times and dates, job requirements and tasks, signature authorities, OHS requirements, company requirements, compliance with relevant manufacturer requirements, warranties and service information.
<b>Key systems</b>	<p>Restricted, semi-restricted and non-restricted system numbers, manufacturer restricted, factory restricted, locksmith restricted/managed, association restricted.</p> <p>Levels including (KD, KA, MK,GMK,GGMK)</p>
<b>Masterkey system</b>	A generic term to describe a group of cylinders operated by more than one key
<b>System expansion</b>	Creation of excess codes to allow for lost keys, unusable codes and future customer requirements, multibroaching
<b>Calculations</b>	Mathematical patterns
<b>Documentation</b>	Materials used, identified faults, warranties and recommendations, costs.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Locksmithing
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## MEM20008A Develop and implement a masterkey system

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers creating new commercial masterkey systems and expanding existing keying systems using even cut and rotating constant progression methods. Emphasis is on cross keying, submasterkeying, selective masterkeying, construction keying, maisonning and hierarchical systems up to and including a GGMK system.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to writing masterkey systems for high security cylinders, primarily for commercial operations. Systems are written manually and using a computer masterkeying package.</p> <p>All relevant legislative requirements, policies and procedures and codes of practice are adhered to including hazardous and risk assessment, use of codes of practice, ergonomics.</p> <p>If a security survey/site assessment is required, then Unit MEM20014A (Perform a site security survey) should also be selected.</p> <p>For standard hierarchical keying, refer to Unit MEM20007A (Plan and prepare a masterkey system).</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM20001A	Produce keys
	MEM20002A	Assemble and test lock mechanisms
	MEM20007A	Plan and prepare a masterkey system

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess customer requirements	1.1. Physical characteristics of existing locks and other security devices are considered and requirement for additional site inspection is determined.

ELEMENT	PERFORMANCE CRITERIA
	<p>1.2.Customer access and task requirements are discussed and clarified according to organisational procedures.</p> <p>1.3.Customer requirements are evaluated with respect to current capacity, and recommendations are made for the design of new/expanded system.</p> <p>1.4.Personal limitations in assessing requirements for masterkey system are identified and assistance is sought from appropriate person(s) in accordance with organisational procedures.</p>
2. Design masterkey system and system modifications	<p>2.1.Commercial masterkey system is designed to meet customer complex access requirements.</p> <p>2.2.System is checked for interchange.</p> <p>2.3.Principles and processes of masterkeying are applied in accordance with industry practice and organisational requirements.</p>
3. Finalise system design	<p>3.1.Final system design and keying requirements are reviewed and confirmed with appropriate person(s) in accordance with organisational requirements.</p> <p>3.2.Documentation is prepared to allow for future interpretation and design requirements.</p> <p>3.3.Documentation is accurately prepared and processed and stored in accordance with client, legislative and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- listening and questioning
- reading architectural plans, floor plans and charts
- evaluating system and expansion requirements
- determining the required structure of a keying system based on customer requirements
- developing key matrix

## REQUIRED SKILLS AND KNOWLEDGE

- developing and reading progression charts for in-line key systems using even cut and rotating constant methods
- developing and reading progression charts for rotating disc, radial pin and pin sidebar key systems
- selecting codes from progression chart that maximise system security
- checking own and others' codes for interchange
- identifying incidental masters in a key system and using them to achieve complex access requirements
- selecting groups of codes to form a maisonned cylinder
- determining the structure of the design of an existing system and the maximum number of codes that can be produced
- identifying any unused codes in an existing system
- expanding an existing key system by using multibroached plugs/barrels
- expanding an existing key system by converting the progression from even cut to rotating constant
- creating/saving and storing information/documentation
- applying calculations and formulae within the scope of this unit

## Required knowledge

Look for evidence that confirms knowledge of:

- record keeping and management
- manufacturers'/Australian/building standards
- product knowledge/limitations
- key matrixes and schedules
- allowances for expansion
- operation and limitations of masterkey systems
- levels of systems (KD, KA, MK, GMK, GGMK)
- door handing
- cylinder types
- principles of construction keying, submaster keying, cross keying, selective keying, maison keying
- criteria for key code selection
- strategies for checking key systems for interchange
- strategies for checking key systems for incidental masters
- strategies for using incidental masters to create submaster keys, cross keys and selective keys
- strategies for selecting groups of codes to form a maisonned cylinder
- calculations and formulae within the scope of this unit

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to develop and implement a masterkey system, which has complex access requirements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and implementing a masterkey systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Task requirements**

Specific client requirements and quantities, completion times and dates, job requirements and tasks, signature authorities, OHS requirements, company requirements, compliance with relevant manufacturer requirements, warranties and service information

**Expanded**

Creation of excess codes to allow for lost keys, unusable codes and future customer requirements, multibroaching

**Masterkey system**

A generic term to describe a group of cylinders operated by more than one key

**Commercial masterkey systems**

Currently available commercial cylinders e.g. rotating disc tumbler (Abloy), radial pin tumbler (Kaba), pin sidebar (Bilock) and multibroach inline pin tumbler cylinders

**Complex access requirements**

Cross keying, submaster keying, selective keying, construction keying and maisonning

**Interchange**

- Interchange is the all-compassing word for the different types
- Accidental interchange is when a key operates a cylinder in system that it is not intended to operate

**Documentation**

Materials used, identified faults, warranties and



**RANGE STATEMENT**

	recommendations, costs
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**Unit Sector(s)**

Unit sector	
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**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	Locksmithing
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## MEM20009A Gain entry and reinstate fire and security containers

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers gaining entry to fire and security containers fitted with mechanical and electronic locking systems. It also covers straightforward reinstatement of the locking system by removal and replacement of component parts.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit may be applied to fire and security containers for commercial and domestic use. The focus is on both mechanical and electronic safe locking systems.</p> <p>Basis for entry includes lockout (keys inside), lost keys (rekeys), malfunction, and damage caused by burglary or user.</p> <p>It requires an ability to safely remove, replace and reinstate original and replacement components and locking systems.</p> <p>Appropriate factors that ensure conformance to specifications, operational performance, quality and safety must be applied. These include locksmithing principles, ethics, techniques, procedures and safe workshop practices.</p> <p>If welding skills are required, then the appropriate units should be selected.</p> <p>Where manual handling for removal of safe is required, Unit MEM11011B (Undertake manual handling) should also be selected.</p> <p>Where repairs to fire and security containers are required, unit MEM20011A (Service and repair fire and security containers) should also be selected.</p>
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	<b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM18002B	Use power tools/hand held operations
	MEM20001A	Produce keys
	MEM20004A	Gain entry

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish entry requirements, authorisations and ownership	<p>1.1.Safe ownership, contents and ownership of contents are established and verified in accordance with organisational and industry procedures.</p> <p>1.2.Safe type, locking mechanism and other relevant information is established from appropriate sources and in accordance with organisational and customer requirements.</p> <p>1.3.Nature of problem and circumstances of prior operation are established in accordance with organisational procedures, inspection/diagnostic techniques and original specifications.</p> <p>1.4.Appropriate entry method is selected in accordance with specific circumstances, customer requirements and organisational procedures.</p> <p>1.5.Appropriate location of work is determined and removal of safe is arranged, if necessary.</p>
2. Gain entry to fire and security containers	<p>2.1.Site access requirements are identified and appropriate arrangements are made.</p> <p>2.2.Potential and existing risks and hazards are identified and managed, area is made secure, and privacy/security of environment are ensured in accordance with organisational and legislative requirements.</p> <p>2.3.Safe work practices are observed to minimise risk of injury to self or others in accordance with OHS policies and procedures and organisational requirements.</p> <p>2.4.Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements.</p> <p>2.5.Tools, equipment, materials and consumables are selected appropriate to entry requirements and checked for serviceability in accordance with manufacturers' specifications and organisational procedures.</p> <p>2.6.Entry is gained in accordance with applicable legislation, codes, regulations and standards.</p>
3. Reinstall fire and security container	<p>3.1.Where applicable, replacement and/or repaired parts are selected as appropriate for reassembly.</p> <p>3.2.Lock assemblies and components are dismantled/removed using appropriate organisational</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>procedures, industry practices, tools and equipment.</p> <p>3.3.Sub-assemblies are inspected, tested and adjusted for compliance to original factory assembly and function.</p> <p>3.4.Components are prepared, assembled and adjusted using fastening equipment and methods that ensure conformance to specifications, correct functioning, quality and safety of the completed assembly.</p> <p>3.5.Lubrication, packing, sealing materials are selected and applied correctly in accordance with job specifications.</p> <p>3.6.Locking system is inspected, tested and adjusted as necessary for compliance to original factory assembly and functioning.</p>
4. Finalise entry and reinstatement process	<p>4.1.Documentation is completed and processed in accordance with legislative and organisational requirements.</p> <p>4.2.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>4.3.Safe is cleaned and returned to serviceable condition.</p> <p>4.4.Customer is advised of work undertaken, further recommended actions and any other relevant information.</p> <p>4.5.Customer is instructed, as necessary, in accordance with organisational procedure and manufacturer recommendations.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting specifications, charts, manuals, diagrams and related information specific to gaining entry
- questioning, confirming and clarifying information

## REQUIRED SKILLS AND KNOWLEDGE

- identifying safe locking components and associated equipment
- checking functioning of safe locking systems
- tracing faults
- selecting and using appropriate tools and equipment, materials and consumables
- applying safe work practices
- identifying and acting on actual and potential hazards
- identifying alternative servicing and repair options
- disassembling and assembling components
- documenting information
- housekeeping
- undertaking calculations and measurement within the scope of this unit

### Required knowledge

Look for evidence that confirms knowledge of:

- sources of specifications and other relevant information for safe locking systems
- types and classes of safes and locks
- barrier materials used
- tools and equipment to suit entry to specific safes
- components of safe locking systems
- principles of safe systems and component function
- technical terminology relating to safes
- operation of specific locks
- common safe design problems and servicing issues,
- faults arising from vandalism, misuse, wear etc.
- checks and tests to confirm service requirements
- organisational procedures for establishing service requirements
- procedures to establish and verify safe and contents ownership
- obligations, responsibilities, disclaimers and reasons for verifying ownership
- environmental, physical and behavioural hazards in relation to safe and surrounds
- operating principles of safes
- personal liability for safety and duty of care
- personal protective clothing, equipment and safe working procedures
- factors impacting on feasibility of repair or replacement
- dismantling and assembly procedures for a range of safe locks
- documentation and recording procedures
- procedures for replacing worn and damaged parts, removing foreign objects and lubricating, packing and sealing components
- organisational requirements for cleaning and storage
- key blanks to suit model and mechanical/electronic part of lock
- programming and operating procedures for electronic locks

**REQUIRED SKILLS AND KNOWLEDGE**

- reasons for care and precision

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to gain entry to and reinstate fire and security containers. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gaining entry to and reinstating fire and security containers, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not

<b>EVIDENCE GUIDE</b>	
	require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Safe type</b>	Plate safes, fire, data, cash and/or jewellery, under-floor, wall, bank safes and vaults
<b>Appropriate sources</b>	Catalogues, manufacturer manuals, drawings, detailed/technical sketches and associated data sheets
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use, organisational processes and procedures, documentation processes, product and process training
<b>Customer requirements</b>	Function and capabilities, access issues, service and maintenance requirements, product operation and warranty information, costings
<b>Entry method</b>	Mechanical drilling and cutting, safe lever lock - impressioning reading, picking, manipulation of mechanical combination locks, alternative



<b>RANGE STATEMENT</b>	
	methods
<b>Risks and hazards</b>	Safe construction, chemical, environmental and material hazards, lifting and handling, use of mechanical and fuel gas cutting equipment
<b>OHS policies, procedures and practices</b>	Assessment of actual and potential risk, identification of hazards, safety practices and regulations, safe use of tools and equipment, individual responsibilities and obligations, safety training and procedures, emergency and first aid procedures, working in confined spaces, use of personal protective equipment, industry standards and codes of practice
<b>Personal protective equipment</b>	Safety glasses, earmuffs/plugs, safety vests, hard hats, gloves, knee pads, safety boots, warning signs and tapes, fire extinguisher, first aid kit
<b>Tools and equipment</b>	<ul style="list-style-type: none"> <li>Hand and power tools and accessories specific to gaining entry - hardened drill bits, special-purpose equipment e.g. borescope, combination lock automatic dialler (soft drill), listening devices, flexilight, fibre optical scope, vacuum cleaner, magnetic based drills, lever rigs</li> <li>Measuring equipment includes vernier callipers, rules, squares and templates, gauges</li> </ul>
<b>Legislation, codes, regulations and standards</b>	ASIO regulations, industry licensing, industry codes of practice, privacy laws, Australian standards, building codes and those of other regulatory bodies, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws
<b>Materials and consumables</b>	Lubricants, adhesives and sealants, cleaning materials, wire and cable, replacement parts
<b>Lock assemblies and components</b>	Keylocks, keyless combination locks, electronic digital, electronic and mechanical time delay
<b>Documentation</b>	Historical records, procedures and measurements for opening specific safes, job sheets, invoices, warranties

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Locksmithing
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## MEM20010A Gain entry and reinstate automotive locking systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers gaining entry to all types of automobiles fitted with mechanical and or electronic locking systems. It also covers straightforward reinstatement of the vehicle locking system by removal and replacement of component parts.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit may be applied to work on commercial and private use vehicles. The focus is on both mechanical and electronic automotive locking systems.</p> <p>Basis for entry includes lockout (keys inside), lost keys (rekeys), malfunction, and damage caused by burglary or user.</p> <p>It requires an ability to safely gain entry to a vehicle taking into account factors that ensure conformance to specifications and operational performance. These include locksmithing principles, ethics, techniques, procedures and safe work practices.</p> <p>If repairs greater than straightforward remove and replace are required, Unit MEM20012A (Service and repair mechanical automotive locking systems) should also be considered.</p> <p>Where interpretation of detailed, complex manufacturer information and specifications is required, Unit MEM16012A (Interpret technical specifications and manuals) should also be considered.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM20001A	Produce keys
	MEM20002A	Assemble key lock mechanisms
	MEM20004A	Gain entry

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish entry	1.1.The reason for entry is established.

ELEMENT	PERFORMANCE CRITERIA
requirements to auto locking system	<p>1.2. Authenticity of request is verified in accordance with organisational and industry procedures.</p> <p>1.3. Nature of problem and circumstances of prior operation are established in accordance with organisational procedures, inspection/diagnostic techniques and original specifications.</p> <p>1.4. Vehicle, locking system and other relevant information is identified from appropriate sources and in accordance with organisational and customer requirements.</p> <p>1.5. Specifications for components are obtained from appropriate source and are interpreted correctly.</p>
2. Gain entry to vehicle	<p>2.1. Appropriate entry method is selected in accordance with specific circumstances, customer requirements and organisational procedures.</p> <p>2.2. Tools, equipment, materials and consumables are selected appropriate to entry requirements and checked for serviceability in accordance with manufacturers' specifications and organisational procedures.</p> <p>2.3. Selected tools are used correctly to gain entry using appropriate industry practices.</p> <p>2.4. Entry is gained in accordance with applicable legislation, codes, regulations and standards.</p>
3. Re-instate automotive locking components and system	<p>3.1. Where applicable, replacement and/or repaired parts are selected for reassembly.</p> <p>3.2. Lock assemblies and components are dismantled/removed using appropriate organisational procedures, industry practices, tools and equipment.</p> <p>3.3. Sub-assemblies are inspected, tested and adjusted as necessary for compliance to original factory assembly and functioning.</p> <p>3.4. Appropriate techniques are applied in the preparation, assembly and adjustment of components parts using fastening equipment and methods which ensure conformance to specifications, operational performance, quality and safety of the completed assembly.</p> <p>3.5. Correct lubrication, packing, sealing materials are selected and applied correctly in conformance to job specifications.</p> <p>3.6. Locking system is inspected, tested and adjusted as necessary for compliance to original factory</p>

ELEMENT	PERFORMANCE CRITERIA
	assembly and functioning.
4. Finalise entry and reinstatement process	<p>4.1. Documentation is completed and processed in accordance with legislative and organisational requirements.</p> <p>4.2. Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>4.3. Vehicle is cleaned and returned to serviceable condition.</p> <p>4.4. Customer is advised of work undertaken, further recommended actions and any other relevant information.</p> <p>4.5. Customer is instructed, as necessary, in accordance with organisational procedure and manufacturer recommendations.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting specifications, charts, manuals, diagrams and related information specific to gaining entry
- confirming and clarifying information
- identifying automotive locking components and associated equipment
- checking functioning of locking systems
- tracing faults
- selecting and using appropriate tools and equipment, materials and consumables
- applying safe work practices
- identifying and acting on actual and potential hazards
- disassembling and assembling components
- documenting information
- housekeeping

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- types of vehicle locking systems - mechanical and electronic
- attachment methods for window winders, internal handles, snibs, trims, cylinders, locks and external handles
- release positions of ignition lock
- release positions of air bag, front and side and appropriate safety procedures
- break-off bolts, removal and replacement
- window winders and door trims
- door lock retainers
- central locking
- linkages and springs
- use and application of personal protective equipment
- safe work practices and procedures
- hazards and control measures associated with gaining entry to automotive locking systems

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to gain entry to and reinstating automotive locking systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with gaining entry to and reinstating automotive locking systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Appropriate sources</b>	<p>Catalogues, manufacturer manuals, drawings, detailed/technical sketches and associated data sheets</p>



<b>RANGE STATEMENT</b>	
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use, organisational processes and procedures, documentation processes, product and process training
<b>Customer requirements</b>	Function and capabilities, access issues, service and maintenance requirements, product operation and warranty information, costings
<b>Entry method</b>	Pick, impressioning, reading, manipulate linkages, alternative methods
<b>Tools and equipment</b>	Hand and power tools specific to gaining entry, power tools and accessories, diagnostic specialist equipment, fixing tools, special-purpose equipment, vacuum cleaner
<b>Materials and consumables</b>	Lubricants, adhesives and sealants, cleaning materials, wire and cable
<b>Legislation, codes, regulations and standards</b>	Industry licensing, industry codes of practice, privacy laws, Australian standards, building codes and those of other regulatory bodies, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws
<b>Documentation</b>	Historical records, procedures and measurements for opening specific vehicles, job sheets, invoices, warranties

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Locksmithing
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## MEM20011A Service and repair fire and security containers

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers dismantling, inspecting, repairing, replacing, servicing and assembling fire and security containers and their components.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to service and repair work on commercial and domestic fire and security containers. It may apply to regular servicing or call-out work and may be required after entry has been gained.</p> <p>Appropriate factors that ensure conformance to specifications, operational performance, quality and safety must be applied. These include locksmithing principles, ethics, techniques, procedures and safe workshop practices.</p> <p>Where interpretation of detailed, complex manufacturer information and specifications is required, Unit MEM16012A (Interpret technical specifications and manuals) should also be considered.</p> <p>Where gaining entry and re-instatement by straightforward replacement of existing or replacement parts is required, Unit MEM20009A (Gain entry and reinstate fire and security containers) should be selected.</p> <p>If welding skills are required, then appropriate units should be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p>
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	<b>Unit Weight: 6</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM20001A	Produce keys
	MEM20002A	Assemble and test lock mechanisms

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify service requirements	<p>1.1. Ownership of safe/container and contents is established and verified in accordance with organisational, legal and industry procedures.</p> <p>1.2. Type of safe and lock mechanism specifications are obtained from appropriate sources and in accordance with organisational and customer requirements.</p> <p>1.3. Nature of any damage or malfunction to exterior, interior and lock components is established in accordance with organisational procedures, established inspection/diagnostic techniques and original specifications.</p> <p>1.4. Service and repair requirements and other information relevant to task are established in accordance with customer needs, organisational and manufacturer specifications and legislation, codes, regulations and standards.</p> <p>1.5. Appropriate location of work is determined and removal of safe is arranged, if necessary.</p>
2. Repair, replace and service safe components	<p>2.1. Risks and hazards are identified and area is made secure.</p> <p>2.2. Safe/container locking components are inspected and further specific repair/service requirements, options and recommended actions are established in accordance with organisational requirements and factors impacting on feasibility of repair.</p> <p>2.3. Lock assemblies and components are dismantled using appropriate organisational procedures, industry practices, tools and equipment.</p> <p>2.4. Components are repaired/replaced/serviced as required, necessary and practicable.</p> <p>2.5. Appropriate lubrication and sealing materials are selected and applied in conformance to standard locksmithing procedures.</p> <p>2.6. Boltwork and internal lock components are inspected, tested and adjusted as necessary for compliance to original factory assembly and functioning.</p>
3. Finalise servicing/repair process	<p>3.1. Function of specific components and entire locking system is tested for compliance with operational specifications and adjusted as necessary.</p> <p>3.2. Documentation is completed and processed in</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>accordance with legislative, assignment and organisational requirements.</p> <p>3.3. Work area, tools and equipment are cleaned and stored in accordance with occupational health and safety policies, procedures and practices and organisational requirements.</p> <p>3.4. Safe/container is cleaned and returned to service according to organisational and customer requirements.</p> <p>3.5. Customer is instructed, as necessary, in accordance with organisational procedure and manufacturer recommendations.</p> <p>3.6. Work is confirmed with appropriate person(s) in accordance with organisational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting specifications, charts, manuals, diagrams and related information specific to servicing and repair of fire and security containers
- confirming and clarifying information
- identifying safe locking components and associated equipment
- checking functioning of safe locking systems
- tracing faults
- selecting and using appropriate tools and equipment, materials and consumables
- applying safe work practices
- identifying and acting on actual and potential hazards
- identifying alternative servicing and repair options
- disassembling and assembling components
- documenting information
- housekeeping

#### Required knowledge

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms knowledge of:

- sources of specifications and other relevant information for safe locking systems
- components of safe locking systems
- principles of system and component function
- technical terminology relating to safes
- rating system (e.g. underwriters laboratories)
- manipulation-proof ratings (classes)
- operation of specific locks
- common safe design problems and servicing issues
- faults arising from vandalism, misuse, wear etc.
- checks and tests to confirm service requirements
- procedures for establishing service requirements
- procedures to establish and verify safe and contents ownership
- obligations, responsibilities, disclaimers and reasons for verifying ownership
- environmental, physical and behavioural hazards in relation to safe and surrounds
- operating principles of safes
- personal liability for safety and duty of care
- personal protective equipment
- safe work practices and procedures
- factors impacting on feasibility of repair/replacement
- dismantling and assembly procedures for a range of safe locks
- documentation and recording procedures
- procedures for replacing worn and damaged parts, removing foreign objects and lubricating (non-dry/non grease), packing and sealing components
- organisational requirements for cleaning and storage
- key blanks to suit model and mechanical/electronic part of lock
- programming and operating procedures for electronic locks
- reasons for care and precision

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to service, repair, test and return to service fire and security containers. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with servicing and repair of fire and security containers, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Types of safe</b>	Plate safes, fire, data, cash and/or jewellery, under-floor, wall, bank safes and vaults
<b>Lock mechanism</b>	Keylocks, keyless combination locks, electronic digital, electronic and mechanical time delay
<b>Appropriate sources of information</b>	Catalogues, manufacturer manuals, drawings, detailed/technical sketches and associated data sheets, colleagues/specialists, internet
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use, organisational processes and procedures, documentation processes, product and process training
<b>Customer requirements</b>	Function and capabilities, access issues, service and maintenance requirements, product operation and warranty information, costings, maintaining security
<b>Service and repair requirements</b>	Checking components for serviceability and integrity. Removal, repair, service and replacement of lock components. Removing boltwork and re-lockers, dismantling locks, inspecting wheel packs for wear and damage, servicing and repairing/replacing combination locks/lever locks, hinges and internal locking compartments
<b>Other information</b>	Schedules, timeframes, access and site information, products, installation and upgrade requirements, specific client requests, materials, costings, warranties and service information, legislation, codes and regulatory requirements, OHS requirements

<b>RANGE STATEMENT</b>	
<b>Legislation, codes, regulations and standards</b>	ASIO regulations, industry licensing, industry codes of practice, privacy laws, Australian standards, building codes and those of other regulatory bodies, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws
<b>Risks and hazards</b>	Safe construction, chemical and material hazards, lifting and handling, use of mechanical and fuel cutting equipment
<b>Tools and equipment</b>	Hand tools relating to safe service and repair, power tools and accessories, various change keys to suit the safe
<b>Materials and consumables</b>	Appropriate lubricants, adhesives and sealants, cleaning materials, seals
<b>Documentation</b>	Historical records, procedures and measurements for opening specific safes, job sheets, invoices, warranties
<b>OHS policies, procedures and practices</b>	<ul style="list-style-type: none"> <li>Relevant OHS policies, procedures include assessment of actual and potential risk, identification of hazards, safety practices and regulations, safe use of tools and equipment, individual responsibilities and obligations, safety training and procedures, emergency and first aid procedures, working in confined spaces, use of personal protective equipment, industry standards and codes of practice</li> <li>Personal protective equipment may include safety glasses, earmuffs/plugs, safety vests, hard hats, gloves, knee pads, safety boots, warning signs and tapes, fire extinguisher, first aid kit</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Locksmithing
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## MEM20012A Service and repair mechanical automotive locking systems

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying service and repair requirements for mechanical automotive locking systems; repairing, replacing and servicing such systems; and finalising the servicing process.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit may be applied to work on commercial and private use vehicles. It applies to mechanical locking systems. It requires an ability to safely remove, repair, service and replace components with special regard to associated equipment, such as supplemental restraint systems (SRS), steering locking and anti-theft devices.</p> <p>Appropriate factors that ensure conformance to specifications, operational performance, quality and safety must be applied. These include locksmithing principles, ethics, techniques, procedures and safe workshop practices.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM20001A	Produce keys
	MEM20002A	Assemble and test lock mechanisms

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify service and repair requirements	1.1. Ownership is established and verified in accordance with organisational and industry procedures. 1.2. System and component specifications and other relevant information is obtained from appropriate

ELEMENT	PERFORMANCE CRITERIA
	<p>sources and in accordance with organisational and customer requirements.</p> <p>1.3.Nature of damage is established in accordance with organisational procedures, established inspection/diagnostic techniques and original specifications.</p> <p>1.4.Service and repair requirements and other information relevant to task are established in accordance with customer needs, organisational and manufacturer specifications and legislation, codes, regulations and standards.</p>
2. Repair, replace and service automotive locking system	<p>2.1.Risks and hazards are identified and area is made secure.</p> <p>2.2.Specific isolation and/or safety measures are applied with special regard to associated equipment.</p> <p>2.3.OHS policies procedures and practices are applied according to organisational and legislative requirements.</p> <p>2.4.Lock assemblies and components are inspected and repaired/replaced and serviced as appropriate and practicable, in accordance with organisational requirements, industry practices and factors impacting on feasibility of repair.</p> <p>2.5.Tools, equipment, materials and consumables are selected, checked for serviceability and used in accordance with manufacturers' specifications and organisational procedures.</p> <p>2.6.Sub-assemblies and assemblies are inspected, tested and adjusted as necessary for compliance to original factory assembly and functioning.</p>
3. Finalise servicing process	<p>3.1.Function of entire locking system is checked for compliance with operational specifications and is adjusted as necessary.</p> <p>3.2.Documentation is completed and processed in accordance with legislative, assignment and organisational requirements.</p> <p>3.3.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>3.4.Vehicle is cleaned and returned to serviceable condition according to customer and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting specifications, charts, manuals, diagrams and related information specific to service and repair of mechanical automotive locking systems
- confirming and clarifying information
- identifying mechanical automotive locking components and associated equipment
- checking functioning of locking systems
- tracing faults
- selecting and using appropriate tools and equipment, materials and consumables
- applying safe work practices
- identifying and acting on actual and potential hazards
- identifying alternative servicing and repair options
- disassembling and assembling components
- documenting information
- housekeeping

#### Required knowledge

Look for evidence that confirms knowledge of:

- attachment methods for window winders, internal handles, snibs, trims, cylinders, locks and external handles
- system and component specifications
- sources of specifications and other relevant information for mechanical automotive locking systems
- components of locking system
- principles of system and component function
- technical terminology
- operation of specific locks
- common design problems
- faults arising from vandalism, misuse, wear etc.
- checks and tests to confirm service requirements
- organisational procedures for establishing service requirements
- procedures to establish and verify vehicle ownership
- reasons for verifying ownership

**REQUIRED SKILLS AND KNOWLEDGE**

- operating principles, release positions and isolation techniques for air bags
- personal liability for safety and duty of care
- applicable legislation, codes, regulations and standards
- OHS policies, procedures and practices
- personal protective clothing, equipment
- safe working practices
- environmental, physical and behavioural hazards in relation to vehicle and surrounds
- factors impacting on feasibility of repair or replacement
- dismantling procedures for a range of automotive locks
- documentation and recording procedures
- procedures for replacing worn and damaged parts, removing foreign objects and lubricating, packing and sealing components
- organisational requirements for cleaning and storage
- reasons for care and precision

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to dismantle, inspect, repair, replace, service and assemble and test mechanical automotive locking components and systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic



**EVIDENCE GUIDE**

	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with servicing and repair of mechanical automotive locking systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Appropriate sources of information**

Catalogues, manufacturer manuals, drawings, detailed/technical sketches and associated data sheets

<b>RANGE STATEMENT</b>	
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use, organisational processes and procedures, documentation processes, product and process training
<b>Customer requirements</b>	Function and capabilities, access issues, service and maintenance requirements, product operation and warranty information, costings
<b>Repair/service requirements</b>	Removal, repair, service and replacement of automotive lock components
<b>Other information</b>	Schedules, timeframes, access and site information, products, installation and upgrade requirements, specific client requests, materials, costings, warranties and service information, legislation, codes and regulatory requirements, OHS requirements
<b>Legislation, codes, regulations and standards</b>	Industry licensing, industry codes of practice, privacy laws, Australian standards, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws
<b>Risks and hazards</b>	Supplemental restraint systems (SRS) systems (air bags) are disabled to prevent accidental triggering. Unique dangers arising from working on the roadside. Non-compliance with manufacturer recommendations, materials handling, chemical, environmental and physical hazards
<b>Associated equipment</b>	SRS, steering locking and anti-theft devices
<b>OHS policies, procedures and practices</b>	<ul style="list-style-type: none"> <li>Assessment of actual and potential risk, identification of hazards, safety practices and regulations, safe use of tools and equipment, individual responsibilities and obligations, safety training and procedures, emergency and first aid procedures, working in confined spaces, industry standards and codes of practice</li> <li>Use of personal protective equipment such as safety glasses, earmuffs/plugs, safety vests,</li> </ul>

<b>RANGE STATEMENT</b>	
	hard hats, gloves, knee pads, safety boots, warning signs and tapes, fire extinguisher, first aid kit
<b>Lock assemblies and components</b>	Inline, single and double sided, 2 and 4 track, tibble (rotating disc), dimple, sidebar, split wafer, new and other mechanisms
<b>Tools and equipment</b>	Tools, power tools and accessories, specialist equipment, fixing tools, special-purpose equipment, vacuum cleaner
<b>Materials and consumables</b>	Lubricants, adhesives and sealants, cleaning materials, wire and cable
<b>Documentation</b>	Historical records, procedures and measurements for opening specific vehicles, job sheets, invoices, warranties

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Locksmithing
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## MEM20013A Service automotive transponder systems

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying, analysing, encoding and re-encoding (programming) automotive transponder security systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit may be applied to work on commercial and private use vehicles. It applies to electronic locking systems, including programming transponder keys.</p> <p>It requires an ability to safely remove and replace components with special regard to associated equipment, such as supplemental restraint systems (SRS), electronic immobilisers, steering locking and anti-theft devices.</p> <p>Appropriate factors that ensure conformance to specifications, operational performance, quality and safety must be applied. These include locksmithing principles, ethics, techniques, procedures and safe workshop practices.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM20001A	Produce keys

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify service and repair requirements	<p>1.1. Ownership is established and verified in accordance with organisational and industry procedures.</p> <p>1.2. System and component specifications and other relevant information is obtained from appropriate sources and in accordance with organisational and customer requirements.</p> <p>1.3. Nature of damage is established in accordance with organisational procedures, established inspection / diagnostic techniques and original specifications.</p> <p>1.4. Service requirements and other information relevant to task are established in accordance with customer needs, organisational and manufacturer specifications</p>

ELEMENT	PERFORMANCE CRITERIA
	and legislation, codes, regulations and standards.
2. Service automotive transponder system	<p>2.1.Risks and hazards are identified and area is made secure.</p> <p>2.2.Specific isolation and/or safety measures are applied with special regard to associated equipment.</p> <p>2.3.OHS policies procedures and practices are applied according to organisational and legislative requirements.</p> <p>2.4.Tools, equipment, materials and consumables are selected, checked for serviceability and used in accordance with manufacturers' specifications and organisational procedures.</p>
3. Program transponder keys	<p>3.1.Personal limitations in programming are identified and assistance is sought from appropriate sources in accordance with organisational procedures.</p> <p>3.2.Programming requirements are established in accordance with organisational and supplier requirements.</p> <p>3.3.Keys are programmed to correct specification.</p> <p>3.4.System function is tested to ensure correct operation.</p>
4. Finalise servicing process	<p>4.1.Documentation is completed and processed in accordance with legislative, assignment and organisational requirements.</p> <p>4.2.Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements.</p> <p>4.3.Vehicle is cleaned and returned to serviceable condition according to customer and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

## REQUIRED SKILLS AND KNOWLEDGE

- interpreting specifications, charts, manuals, diagrams and related information specific to service of automotive transponder systems
- encoding and re-encoding transponder systems
- confirming and clarifying information
- identifying automotive locking components and associated equipment
- checking functioning of locking systems
- tracing faults
- selecting and using appropriate tools and equipment, materials and consumables
- applying safe work practices
- identifying/acting on actual and potential hazards
- identifying alternative servicing and repair options
- disassembling and assembling components
- documenting information
- housekeeping

## Required knowledge

Look for evidence that confirms knowledge of:

- system and component specifications
- sources of specifications and other relevant information for automotive transponder systems
- principles of system and component function
- types of transponders
- technical terminology
- common design problems
- faults arising from vandalism, misuse, wear etc.
- checks and tests to confirm service requirements
- organisational procedures for establishing service requirements
- procedures to establish and verify vehicle ownership
- reasons for verifying ownership
- operating principles, release positions and isolation techniques for air bags
- operation and function of transponder and engine immobiliser systems
- personal liability for safety and duty of care
- applicable legislation, codes, regulations and standards
- OHS policies, procedures and practices
- personal protective clothing, equipment
- safe working practices
- environmental, physical and behavioural hazards in relation to vehicle and surrounds
- factors impacting on feasibility of repair or replacement
- dismantling procedures for a range of automotive locks



## REQUIRED SKILLS AND KNOWLEDGE

- documentation and recording procedures
- procedures for replacing worn and damaged parts, removing foreign objects and lubricating, packing and sealing components
- organisational requirements for cleaning and storage
- key blanks to suit model and mechanical/electronic part of lock
- different types of transponder technologies
- programming and operating procedures for encoder/ diagnostic machine
- reasons for care and precision

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to identify, analyse, encode and re-encode automotive transponder security systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated

**EVIDENCE GUIDE**

	with servicing of automotive transponder systems, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate sources of information</b>	Catalogues, manufacturer manuals, drawings, detailed/technical sketches and associated data sheets. Computer software
<b>Organisational requirements</b>	Quality assurance standards and procedures, service standards, safety and OHS practices and obligations, resource storage and use,

<b>RANGE STATEMENT</b>	
	organisational processes and procedures, documentation processes, product and process training
<b>Customer requirements</b>	Function and capabilities, access issues, service and maintenance requirements, product operation and warranty information, costings
<b>Service requirements</b>	Identifying, analysing, encoding and re-encoding automotive transponder security systems
<b>Other information</b>	Schedules, timeframes, access and site information, products, installation and upgrade requirements, specific client requests, materials, costings, warranties and service information, legislation, codes and regulatory requirements, OHS requirements
<b>Legislation, codes, regulations and standards</b>	Industry licensing, industry codes of practice, privacy laws, Australian standards, quality assurance, organisational standards and practices, awards and enterprise agreements, competition, trade and consumer protection laws
<b>Risks and hazards</b>	Supplemental restraint systems (SRS) systems (air bags) are disabled to prevent accidental triggering. Unique dangers arising from working on the roadside. Non-compliance with manufacturer recommendations, materials handling, chemical, environmental and physical hazards
<b>Associated equipment</b>	SRS, electronic immobilisers, steering locking and anti-theft devices
<b>OHS policies, procedures and practices</b>	<ul style="list-style-type: none"> <li>Assessment of actual and potential risk, identification of hazards, safety practices and regulations, safe use of tools and equipment, individual responsibilities and obligations, safety training and procedures, emergency and first aid procedures, working in confined spaces, industry standards and codes of practice</li> <li>Use of personal protective equipment such as safety glasses, earmuffs/plugs, safety vests, hard hats, gloves, knee pads, safety boots, warning signs and tapes, fire extinguisher, first aid kit</li> </ul>

RANGE STATEMENT	
Tools and equipment	Hand tools, specialist diagnostic and encoding equipment
Documentation	Historical records, procedures and measurements for opening specific vehicles, job sheets, invoices, warranties

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Locksmithing
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## MEM20014A Perform a site security survey

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers examining and assessing security requirements across commercial, industrial and domestic applications. This unit has been modified from Unit PRSTS301 Identify technical security requirements in the (PRS03) Asset Security Training Package endorsed 19/03/2003.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit requires the ability to source relevant information, establish security risk and use appropriate assessment methods to ensure an accurate determination of security equipment/system options to meet client needs.</p> <p>Where estimates and quotes are required, Unit PRSTS317 (Provide estimate and quote) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Prepare to assess security requirements	<p>1.1. Job requirements are reviewed and clarified with appropriate person(s) in accordance with organisational requirements.</p> <p>1.2. Discussions with customer are conducted to establish actual and potential security risks and clarify scope of work.</p> <p>1.3. Effective interpersonal techniques are applied when interacting.</p> <p>1.4. Site access and specific site requirements are identified and appropriate arrangements are made as required in accordance with client and organisational requirements.</p> <p>1.5. Personal limitations in assessing security requirements are identified and assistance is sought from appropriate person(s), in accordance with organisational procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Assess security requirements	<p>2.1.Site restrictions, regulations and requirements are identified and complied with in accordance with legislative, client and organisational requirements.</p> <p>2.2.Information is gathered from identified sources and is relevant to assignment requirements in accordance with legislative, client and organisational requirements.</p> <p>2.3.A site assessment is carried out where possible to facilitate an accurate determination of security requirements.</p> <p>2.4.Client assets, activities and existing security arrangements are reviewed to assess the level and range of security risk to client operations.</p> <p>2.5.Weak points, risk areas and environmental factors affecting the security risk of the site are identified and assessed in accordance with organisational procedures.</p>
3. Document security assessment	<p>3.1.Information is recorded and stored in accordance with manufacturer specifications and organisational procedures.</p> <p>3.2.A comprehensive assessment of client security requirements is completed within designated timeframes and presented for review to appropriate person(s).</p> <p>3.3.A security survey is prepared in accordance with industry and organisational standards of style, format and accuracy.</p> <p>3.4.Recommendations for security equipment/systems and alternative options are made in accordance with organisational requirements.</p> <p>3.5.Documentation is processed in accordance with legislative, assignment and organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

Look for evidence that confirms skills in:

- identifying security threats to people, property and premises
- observing and assessing technical security requirements
- reading and interpreting plans, designs and specifications
- applying basic numeracy techniques
- applying safe and efficient work practices
- communicating in a clear and concise manner
- relating to people from different social and cultural backgrounds
- presenting a professional image
- preparing documentation
- planning and sequencing work tasks
- entering data using basic keyboarding skills

### Required knowledge

Look for evidence that confirms knowledge of:

- risk assessment methods and procedures
- available security equipment/system options and basic requirements for installation
- types and functions of security equipment and systems
- building construction methods and types
- organisational and client confidentiality requirements
- basic problem solving strategies
- operational principles of information technology
- principles of effective communication
- documentation requirements and processes

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to examine and assess technical security requirements.



<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assessing technical security requirements, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Job requirements</b>	Instructions from supervisor/management, work schedules and completion dates, specific client requirements, site requirements, security clearance and access requirements, reporting and documentation requirements, budget allocations, associated legislation BCA, fire regulations
<b>Appropriate person(s)</b>	Clients, site managers, project managers, engineers and technicians, technical experts, line managers/supervisors, colleagues, regulatory personnel, security consultants
<b>Organisational requirements</b>	Legal and organisational operational policies and procedures, operations manuals, induction and training materials, insurance policy agreements, client and organisational confidentiality requirements, organisational goals/objectives/plans/systems/ processes, employer and employee rights and responsibilities, own role, responsibility and delegation, quality and continuous improvement processes and standards, client service standards, defined resource parameters, OHS policies/procedures/programs, emergency and evacuation procedures, duty of care, code of conduct, code of ethics, access and equity policy, principles and practice, records and information systems and processes, communication channels and reporting procedures
<b>Customer</b>	Owner, property/other agent, tenant, building supervisor, manager, project manager, government and legal instruments/agencies
<b>Scope of work</b>	Personal protection, access requirements, property or assets, conformance with insurance, legislative or other requirements
<b>Interpersonal techniques</b>	Verbal or non-verbal language, two-way interaction, constructive feedback, active listening,

**RANGE STATEMENT**

	questioning to clarify and confirm understanding, interpreting non-verbal and verbal messages, observation techniques, use of positive, confident and co-operative language, control of tone of voice and body language, use of language and concepts appropriate to cultural differences, use of clear presentations of options and consequences, demonstrating flexibility and willingness to compromise
<b>Site access and specific site requirements</b>	May relate to access and egress points, time of access, access codes, keys, passes, security clearances, union requirements, OHS requirements, building codes and regulations, heritage listings, noise control
<b>Assessment may involve</b>	Discussions with client, visual inspections, review of client floor plans and supporting documentation, questioning police/insurance companies/other bodies
<b>Applicable legislation, codes and national standards</b>	Relevant Commonwealth/State/Territory legislation which affect organisational operation: occupational health and safety, environmental issues, equal employment opportunity, industrial relations, anti-discrimination and diversity, licensing arrangements, Australian standards, quality assurance and certification requirements, relevant industry codes of practice, trade practices, award and enterprise agreements, privacy related legislation
<b>Information</b>	Value or importance of assets, insurance policy agreements, special rooms or areas requiring higher level of protection, current/proposed operating environments, assets and systems, activities and functions, existing security systems/equipment, existing management strategies, business and operational plans, incident history
<b>Site assessment</b>	Type and condition of building structures, identification of risk areas/weak points, site restrictions, regulations and requirements, access and egress patterns, floor plan, existing security equipment/systems

<b>RANGE STATEMENT</b>	
<b>Security risks</b>	Vandalism, sabotage, trespass, break-in, burglary, assault or harm, unauthorised access, theft, pilferage, deliberate/accidental damage
<b>Weak points and risk areas</b>	Unsecured windows, entry points screened from public view, external doors without deadlocks or with hinges opening outward, flimsy building materials, client habits (e.g. doors left unlocked)
<b>Environmental factors</b>	Adequacy of street lighting, traffic flow, neighbourhood crime rating, proximity of other buildings
<b>Security equipment and systems</b>	Detection devices, audible/visual warning devices, cameras, monitors and control equipment, control panels, intercoms, wireless equipment, car alarms, electronic readers, electronic recognition controls, locks and locking systems, grills, lighting, boom gates, turnstiles, bank pop-up screens, smoke detection devices, electric/mechanical fire safety and fire locking systems, power supplies, batteries, security doors and door controls
<b>Security systems</b>	Electronic, mechanical, computerised, procedural
<b>Documentation</b>	Checklists, reports, floor plans, client briefs, specifications, schedules, site survey

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Locksmithing
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## MEM21001A Replace watch batteries, capacitors and bands

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers identifying with customers the battery or capacitor replacement need and/or the repair or replacement of bands. This unit also includes conducting any required water-resistance testing.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to the selection and replacement of electronic watch power sources and bands whilst operating in a watch service and repair workshop or jewellery store offering watch service and repair with access to the appropriate equipment. Applications may also be found in kiosks offering jewellery, key cutting, watch service and repair services.</p> <p>Some knowledge of watch glasses, gasket and other component removal procedures is required. However, this unit does not cover specific replacement procedures.</p> <p>Testing functions relate only to the measurement of voltage, consumption and resistance, and checking for case integrity. For example, when power cells are replaced, it is necessary to establish circuit performance by electrical testing and case integrity by water-resistance testing.</p> <p>To perform additional servicing of watch cases <i>MEM21003A Perform watch case servicing, repair and refurbishment</i> should be selected.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Inspect watch condition and type and discuss performance concerns with customer 1.2. Verify and agree on servicing requirements with customer 1.3. Carry out pre-repair tests to verify water-resistance 1.4. Prepare watch for handover

ELEMENT	PERFORMANCE CRITERIA
	1.5.Record and document repair process
2. Open and close watch cases	2.1.Select and use workshop tools and equipment appropriately 2.2.Identify watch and band construction and components 2.3.Open and close watch cases correctly 2.4.Inspect parts and report and record results 2.5.Verify gasket condition and replace, as required 2.6.Clean cases and bands, as required, during and after repair
3. Select and replace power sources	3.1.Remove power sources using appropriate tools and equipment 3.2.Inspect watch for battery leakage damage and clean or refer for further service, as appropriate 3.3.Assess physical condition of existing cell and its operation under load 3.4.Select, replace and secure appropriate replacement power sources 3.5.Perform integrated circuit resetting or all clear operations as required 3.6.Handle, store and dispose of power sources correctly and in accordance with environmental guidelines
4. Perform electrical testing	4.1.Set up and use multimeters correctly 4.2.Test cell terminal voltage under load using correct methods and equipment 4.3.Test watch circuitry for current consumption using correct methods and equipment 4.4.Confirm results against manufacturer specifications
5. Select and replace bands	5.1.Identify band attachment and removal method 5.2.Remove and replace bands and components, as necessary, using appropriate methods, tools and equipment 5.3.Determine dimensions and type of replacement bands/ components required
6. Conduct water-resistance testing	6.1.Identify watches requiring water-resistance and/or pressure testing 6.2.Select appropriate water-resistance testing methods and equipment according to watch type 6.3.Set up and use equipment to verify results



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying, handling and storing power cells, batteries and capacitors
- handling basic watch repairers' tools (e.g. tweezers, screwdrivers and eyeglasses)
- confirming correct selection of replacement cells by size, capacity and function
- using measuring tools (e.g. vernier callipers and band width gauges)
- setting up and using multimeters and interpreting readings
- conducting water-resistance testing
- communicating with customers

#### Required knowledge

Required knowledge includes:

- watch construction:
  - mechanical, electronic, digital, analog, duo, kinetic and auto quartz
  - function/features/design (e.g. basic operating principle for electronic watches)
- band construction, materials and components:
  - clasps, styles, materials and attachment methods
  - links, end pieces, clasps, buckles, chains, pins and spring bars
- operating principles of power cells, batteries, capacitors and voltages (1.55 V - 3 V)
- how to confirm battery capacity
- handling, storage and disposal procedures for watch power sources
- environmental guidelines and regulations relevant to the disposal of watch power sources
- multimeter types and how to set up, use and record values
- Australian standards for water-resistant watches
- methods of water-resistance testing for watches and advantages and disadvantages of each method
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to replace quartz or electronic watch power sources and bands to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- open and close watches without causing damage to watch or movement
- confirm watch movement's performance
- select correct replacement power sources for watch type and functions
- confirm watch case condition and water-resistance.

#### Context of and specific resources for assessment

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

#### Method of assessment

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and

**EVIDENCE GUIDE**

	<p>application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preparing watch for handover</b>	<p>Preparing watch for handover may include:</p> <ul style="list-style-type: none"> <li>• confirm watch keeping on time</li> <li>• function checking (e.g. calendar, light, chronograph and alarm)</li> <li>• display setting (e.g. time, calendar and other multi-functions)</li> </ul>
<b>Electronic watch</b>	<p>Electronic watch includes watches with:</p> <ul style="list-style-type: none"> <li>• quartz crystal</li> <li>• kinetic mechanism</li> <li>• tunic fork</li> <li>• electronic balance</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• date and extent of repairs completed</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• cost of components replaced or used</li> <li>• time spent on procedure</li> <li>• marking the date of fitting for replacement cell/code</li> <li>• electrical testing results (e.g. current consumption/ running time calculated)</li> <li>• water-resistance test results</li> </ul>
<b>Workshop tools and equipment</b>	<p>Workshop tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• hand tools appropriate to watch case construction and repair of watches</li> <li>• personal protective equipment</li> <li>• non-conductive tweezers, case opening and closing tools, glass and case press, plastic sheet protection, cleaning brushes and rodico</li> </ul>
<b>Watch and band construction and components</b>	<p>Watch and band construction and components may include:</p> <ul style="list-style-type: none"> <li>• mechanical, electronic, digital, analog, duo, kinetic and auto quartz</li> <li>• bracelets, bands, clasps, styles, straps and material construction</li> </ul>
<b>Power sources</b>	<p>Power sources may include:</p> <ul style="list-style-type: none"> <li>• primary and secondary cells</li> <li>• silver oxide cells, including high, low and multi-drain types</li> <li>• capacitors</li> <li>• lithium</li> </ul>
<b>Band attachment and removal</b>	<p>Band attachment and removal may include:</p> <ul style="list-style-type: none"> <li>• springlug, tapered pin, cotter pin and screwed</li> </ul>
<b>Multimeters</b>	<p>Multimeters may include:</p> <ul style="list-style-type: none"> <li>• analog</li> <li>• digital</li> <li>• external power supplies</li> <li>• ampere</li> <li>• volts</li> <li>• Ohms</li> </ul>
<b>Water-resistance testing methods</b>	<p>Water-resistance testing methods may include:</p> <ul style="list-style-type: none"> <li>• Australian standard for watches and</li> </ul>

**RANGE STATEMENT**

	water-resistant/divers watches
	<ul style="list-style-type: none"><li>• vacuum or over pressure</li><li>• air leak</li><li>• water immersion</li><li>• condensation test</li></ul>

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>	

**Competency field**

<b>Competency field</b>	
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## MEM21002A Perform watch movement exchange

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers repairing watches through replacement of quartz and mechanical watch movements. The unit includes cost quotation, removal and replacement of movements, final inspection and completion of repair documentation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the exchange of quartz and mechanical watch movements in kiosks offering jewellery/key cutting/watch service and repair, watch service centres, and jewellery/watchmaking stores.</p> <p>Work may be performed by watchmakers, service technicians and kiosk personnel performing mainly movement exchange.</p> <p>Where water-resistance testing is required, <i>MEM21003A Perform watch case servicing, repair and refurbishment</i> should be selected.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
	MEM21001A	Replace watch batteries, capacitors and bands

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Verify watch condition and performance concerns with customer 1.2. Prepare written and verbal quotations 1.3. Agree with customer on recommended service procedures to remedy faults 1.4. Record and document repair process
2. Open and close watch cases	2.1. Verify and agree on servicing requirements 2.2. Select and use workshop tools and equipment appropriately 2.3. Open and close watch cases correctly 2.4. Verify condition of case back/gaskets and replace, as

ELEMENT	PERFORMANCE CRITERIA
	<p>required</p> <p>2.5.Clean case components, as required</p>
3. Remove and replace watch movements	<p>3.1.Establish appropriate working environment</p> <p>3.2.Identify and follow correct sequence for removal and replacement of watch movements</p> <p>3.3.Remove and replace crown, stem and case fixings without damaging</p> <p>3.4.Determine condition of crown, stem, pendant and pushbuttons, and perform custom replacement, as required</p> <p>3.5.Remove and replace movements without damaging, marking or leaving fingerprints</p> <p>3.6.Verify correct replacement movement is selected</p>
4. Remove and replace hands and dials	<p>4.1.Identify release mechanism for watch dials</p> <p>4.2.Remove and replace hands and dials without marking or damaging components</p> <p>4.3.Check and service hands and dials as required</p> <p>4.4.Fit hands to correctly synchronise with each other, dial batons and calendar</p> <p>4.5.Use correct workshop tools and equipment taking precautions for removal and replacement</p> <p>4.6.Check hands and dial clearances</p>
5. Conduct final inspections	<p>5.1.Inspect watch for cleanliness and rectify imperfections and faults</p> <p>5.2.Check functionality of crown, stems and pushbuttons</p> <p>5.3.Confirm watch performance, hand alignment and calendar function and synchronisation</p> <p>5.4.Record and document repair</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills



## REQUIRED SKILLS AND KNOWLEDGE

Required skills include:

- identifying repair cost
- completing documentation
- cleaning watch components (e.g. watch cases, bands, dials and hands)
- selecting replacement movement or components
- using hand tools and equipment
- measuring and visual alignment of components
- maintaining a clean environment
- identifying and using specific hand tools for dial and hand/pendant/pushbutton removal/ fitting

### Required knowledge

Required knowledge includes:

- types of watch construction
- types of stems and crowns
- hand tools (e.g. files and pin vices)
- stem position for removal
- various watch case components (e.g. types, styles and materials)
- various types, styles and materials of dials and hands
- various watch crown types, styles and materials
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform watch movement exchange to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- replace watch movements for both quartz and

**EVIDENCE GUIDE**

	<p>mechanical watches</p> <ul style="list-style-type: none"> <li>• remove and replace watch movements without damaging or marking</li> <li>• correctly select and fit replacement case parts, crown and stems</li> <li>• correctly remove and replace hands and dials without damaging or marking</li> <li>• ensure correct dial and hand alignment, clearances and calendar synchronisation</li> <li>• ensure cleanliness of the operation is achieved.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

**EVIDENCE GUIDE****Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Record and document repair**

Record and document repair may include:

- date and extent of repair
- cost of replacement part
- time spent on procedure

**Workshop tools and equipment**

Workshop tools and equipment may include:

- specialised hand removers
- case opening tools
- cutting tools
- files
- hand fitting tools
- general hand tools
- cleaning media and lubricants

**Appropriate working environment**

Appropriate working environment may include:

- suitable watchmaker's bench
- clean and orderly work area (precautions taken to minimise dust)
- adequate lighting
- ergonomic chair with adjustable height

**Case fixings**

Case fixings may include:

- case screws
- movement rings

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• stem</li> </ul>
<b>Custom replacement</b>	<p>Custom replacement may include:</p> <ul style="list-style-type: none"> <li>• determining custom stem length</li> <li>• cutting and filing stem end and securing crown</li> <li>• replacing screw or friction fitted worn or damaged pendants</li> <li>• servicing, cleaning and replacing pushbutton</li> <li>• inspecting all crown, pendant, pushbutton gaskets for condition, and replacing and lubricating, as required</li> </ul>
<b>Check and service hands and dials</b>	<p>Check and service hands and dials may include:</p> <ul style="list-style-type: none"> <li>• luminance of hands</li> <li>• dial feet condition</li> <li>• rust and contamination</li> <li>• water marks</li> <li>• damage and wear to hands</li> </ul>
<b>Clearances</b>	<p>Clearances may include:</p> <ul style="list-style-type: none"> <li>• hand clearance from each other, dials and glass</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	
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## MEM21003A Perform watch case servicing, repair and refurbishment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing and repair techniques for watch cases, including replacement techniques for watch glasses, pendants, pushbuttons and correctors, bezels, case backs, gaskets, crowns and bands, straps or bracelets. Also covered is refurbishment techniques for watch case or band by polishing and graining. Additionally, this unit includes standards for water-resistance testing methods and procedures for water-resistant and divers watches.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to cases for all types of watches, including non-water and water-resistant watches and all types of case materials. Servicing, repair and refurbishment would normally be carried out in watch service and repair centres and watchmaking stores where repair services are offered.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
	MEM21002A	Perform watch movement exchange
	MEM21001A	Replace watch batteries, capacitors and bands

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	<ul style="list-style-type: none"><li>1.1. Identify watch case type, functions, construction and components</li><li>1.2. Carry out pre-repair tests to verify water-resistance, as required</li><li>1.3. Prepare written quotation and inform customer of watch case condition and outline recommended service procedures</li><li>1.4. Verify and agree on servicing requirements with customer</li><li>1.5. Prepare watch for handover</li><li>1.6. Record and document repair process</li></ul>

ELEMENT	PERFORMANCE CRITERIA
2. Disassemble watch case and components for servicing	2.1. Establish appropriate working environment 2.2. Open and close watch cases correctly 2.3. Remove watch case, sub-assemblies and components in correct sequence without damaging, marking or leaving fingerprints 2.4. Verify condition of case gaskets and replace, as required
3. Repair and refurbish watch case, sub-assemblies and components	3.1. Inspect condition of watch case including case sub-assemblies and components 3.2. Replace faulty or damaged or worn watch case, sub-assemblies and components 3.3. Select appropriate media for polishing and graining case and band components 3.4. Set up and operate machines and equipment safely for polishing and graining 3.5. Select appropriate case and band cleaning methods 3.6. Inspect watch case for condition and cleanliness and rectify imperfections and faults
4. Reassemble watch case and band components	4.1. Reassemble and fit watch case and band components according to manufacturer specifications 4.2. Lubricate watch case including case sub-assemblies and components and sub-assemblies according to manufacturer specifications 4.3. Verify security, functioning, and operation of watch case and band including sub-assemblies and components 4.4. Apply watch case assembly inspections and precautions
5. Perform water-resistance testing for watch cases	5.1. Verify and confirm water-resistance rating of watch case 5.2. Identify, set up and operate equipment for water-resistance testing and interpret readings 5.3. Verify watch case performance and repair or replace components and gaskets, as required, to industry standards
6. Apply industry workshop standards to perform work	6.1. Use hand tools and equipment safely and correctly 6.2. Handle components without damaging or marking 6.3. Establish a clean and safe work environment



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying various watch case construction materials
- opening and closing watch cases
- selecting watch case and band polishing and graining media
- selecting, removing and replacing various types of watch glasses
- selecting and replacing crowns
- selecting, replacing and lubricating gaskets
- servicing, dismantling and replacing pushbuttons
- selecting and using tools and equipment for servicing watch cases and components
- dismantling/reassembling techniques of watch case and components according to procedures and manufacture guidelines
- conducting water-resistance testing on watch cases
- watch case cleaning
- selecting, removing and replacing various types of watch band construction
- selecting and ordering replacement watch case component parts

#### Required knowledge

Required knowledge includes:

- types of construction of watch cases by style, design, material and quality
- types of watch glass materials, construction and fitting procedures including use of adhesives as required
- types of crown construction by style, design, material and quality
- types of case gasket materials and construction fitting procedures
- types of crown styles, materials and construction
- types of pushbutton construction
- function and operating principles for water-resistance testing
- tools and equipment for servicing watch cases and components
- watch case cleaning methods
- types of band construction, components and materials
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform watch case servicing, repair and refurbishment to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- service, inspect, repair and/or replace watch case components (e.g. glass, crown, pendants and pushbuttons) to manufacturer specifications
- select and use appropriate workshop tools, equipment and media for watch case servicing, polishing and graining
- determine and conduct appropriate tests for water-resistant watches
- safely clean watch cases and bands (e.g. by machine/hand).

#### Context of and specific resources for assessment

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

#### Method of assessment

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with

**EVIDENCE GUIDE**

	<p>application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Watch case type, function, construction and components**

Watch case type, function, construction and components may include:

- pocket watch, wrist watch, ring watch, necklace and specialist watches
- non water-resistant (e.g. two and three piece case)
- water-resistant (e.g. two piece case)
- monocoque (e.g. one piece case)
- materials (e.g. precious metals, stainless steel, ceramic, titanium and others)
- case body, bezel glass, case back, pushbutton,

<b>RANGE STATEMENT</b>	
	case ring and gaskets
<b>Watch case/band condition</b>	Watch case/band condition may include: <ul style="list-style-type: none"> <li>• completeness</li> <li>• scratches, dents and worn plating</li> <li>• general wear and tear</li> <li>• water-resistance performance</li> </ul>
<b>Recommended service procedures</b>	Recommended service procedures may include: <ul style="list-style-type: none"> <li>• replace worn or damaged components</li> <li>• repair or refurbish</li> <li>• case refurbishment to customer requirements</li> </ul>
<b>Record and document repair</b>	Record and document repair may include: <ul style="list-style-type: none"> <li>• extent and date of repair</li> <li>• cost of replacement parts</li> <li>• time spent on procedure</li> </ul>
<b>Appropriate working environment</b>	Appropriate working environment may include: <ul style="list-style-type: none"> <li>• clean bench and working area</li> <li>• adequate lighting and ventilation</li> <li>• tools and equipment organised and in good condition</li> <li>• ergonomic seating</li> <li>• dust extraction</li> </ul>
<b>Case components and movement sub-assemblies</b>	Case components and movement sub-assemblies may include: <ul style="list-style-type: none"> <li>• glass, spring fit, armoured, mineral and sapphire</li> <li>• bezel (e.g. rotating)</li> <li>• case back and gaskets</li> <li>• crown</li> <li>• pendant (e.g. friction fit or screwed)</li> <li>• gaskets</li> </ul>
<b>Inspect condition</b>	Inspect condition may include: <ul style="list-style-type: none"> <li>• originality of components</li> <li>• cleanliness</li> <li>• wear</li> <li>• damage</li> <li>• corrosion</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Watch case assembly inspections and precautions</b>	<p>Watch case assembly inspections and precautions may include:</p> <ul style="list-style-type: none"> <li>• use plastic protection whilst opening and closing</li> <li>• alignment of components (e.g. case back, bezel and glass)</li> <li>• security of pendants (e.g. friction and threaded)</li> <li>• pushbutton operation</li> <li>• screw crowns and stem length</li> <li>• damage to stem when securing crown</li> <li>• cleanliness</li> </ul>
<b>Water-resistance rating</b>	<p>Water-resistance rating may include:</p> <ul style="list-style-type: none"> <li>• minimum standard of 20 metres, or additionally to 30 metres and 50 metres)</li> <li>• minimum standards for divers watch of 100 metres or up to 3000 metres</li> </ul>
<b>Equipment for water-resistance testing</b>	<p>Equipment for water-resistance testing may include:</p> <ul style="list-style-type: none"> <li>• vacuum</li> <li>• over pressure</li> <li>• combined test</li> <li>• water immersion method</li> <li>• air leak method</li> <li>• condensation test</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• pin vices and case holders</li> <li>• case opening and closing tools</li> <li>• glass press and vigor tool</li> <li>• adhesives</li> <li>• polishing machines and various grades of buff wheels</li> <li>• polishing and graining (e.g. 3M media in various grades)</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> </ul>

**RANGE STATEMENT**

	<ul style="list-style-type: none"><li>5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li></ul>
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**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21004A Clean watch and clock components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers cleaning techniques for watch and clock movements, cases and other components by manual, mechanical and electronic methods, using a range of media.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all clock and watch service and repair activities. Applications may be found in all service centres and repair services offered in jewellery and watchmaking stores and trade repairers, either home-based or in commercial locations.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Apply principles of occupational health and safety (OHS) to cleaning activities	1.1. Select and use appropriate personal protective equipment correctly based on information in relevant material safety data sheet (MSDS) 1.2. Identify hazards associated with cleaning equipment and media 1.3. Follow safe work practices and apply hazard control measures, as required 1.4. Follow emergency response procedures
2. Select and prepare appropriate methods, equipment and solutions	2.1. Select cleaning methods, processes and equipment according to type and size of mechanisms, components and cases 2.2. Select cleaning solutions appropriate to component, finish, surface coating and material 2.3. Decant, mix and prepare solutions for use 2.4. Dispose of chemicals according to manufacturer guidelines, legislation and regulations
3. Prepare parts and components for cleaning	3.1. Dismantle watch or clock and component parts to optimise cleaning 3.2. Pre-clean components, as required, for inspection 3.3. Arrange components during machine cleaning to



ELEMENT	PERFORMANCE CRITERIA
	prevent damage 3.4. Arrange and sequence parts and components for cleaning to assist subsequent identification, reassembly and to optimise cleaning
4. Perform cleaning operations	4.1. Set up and operate cleaning equipment correctly, using safe work practices 4.2. Monitor and control exposure of components to solutions during cleaning process 4.3. Remove residues, dry and handle cleaned components, as appropriate 4.4. Arrange storage of cleaned components to maintain finish and cleanliness
5. Assess outcomes of cleaning process	5.1. Verify condition of cleaned components and identify remaining residues and contaminants, damage to surface coatings and other component damage 5.2. Account for all components

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- handling cleaned components
- handling chemicals safely
- operating cleaning machines
- mixing chemicals and solutions
- handling cleaned components to prevent contamination
- storing cleaned components to maintain finish

#### Required knowledge

Required knowledge includes:

- cleaning solutions and uses
- cleaning procedures for different components and finishes
- watch case cleaning methods (ultrasonic, vibratory)

**REQUIRED SKILLS AND KNOWLEDGE**

- cleaning machine types, uses, function and operation
- potential for damage to components by chemicals or cleaning operations
- chemical storage and disposal
- OHS regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to clean watch and clock components to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- prepare solutions and equipment
- work safely with chemicals and equipment
- sort and track components during process
- clean components without damage
- verify components as effectively cleaned.

**Context of and specific resources for assessment**

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

**EVIDENCE GUIDE****Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.
- Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessment may be in conjunction with assessment of other units of competency where required.

**Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Personal protective equipment**

Personal protective equipment may include:

- protective masks
- gloves for handling chemicals
- fire blankets and extinguishers
- ventilation of cleaning area

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• clothing (e.g. dustcoats and aprons)</li> </ul>
<b>Emergency response procedures</b>	<p>Emergency response procedures may include:</p> <ul style="list-style-type: none"> <li>• safe selection and use of fire extinguishers</li> <li>• use of safety blankets and other methods of suppressing solvent-based fires</li> <li>• emergency treatment of eye splashes and chemical burns</li> <li>• carcinogenic effects of chemical inhalation and absorption</li> </ul>
<b>Cleaning methods, processes and equipment</b>	<p>Cleaning methods, processes and equipment may include:</p> <ul style="list-style-type: none"> <li>• mechanical processes (e.g. rotational and vibrational)</li> <li>• electronic (e.g. ultrasonic)</li> <li>• steam cleaning</li> <li>• cleaning machines</li> <li>• cleaning baskets</li> <li>• hand cleaning (e.g. with pith, brushes and peg wood)</li> </ul>
<b>Cleaning solutions</b>	<p>Cleaning solutions may include:</p> <ul style="list-style-type: none"> <li>• number 1 degreasing and cleaning solution (WF1)</li> <li>• customised solutions, ammonia, oleic acid, acetone and water-based solutions</li> <li>• commercial grade ammonia concentrates</li> <li>• rinsing solutions, including hydrocarbon solvents (e.g. Shellite, Mobil B1 and X55)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	
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## MEM21005A Diagnose faults in quartz watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers testing and diagnosing faults in electronic quartz watches.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work in watch service centres, jewellery and watchmaking stores and kiosks offering watch service and repair.</p> <p>The unit covers the skills required to diagnose faults where the power cell performance has already been tested and its condition is assessed as good or the correct terminal voltage under load but the watch continues to indicate faults or is stopped. Appropriate diagnostic testing procedures are required to identify or determine the faults in a quartz watch and the extent of servicing required.</p> <p>For repair of mechanical faults refer to the appropriate mechanical watch service units.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
	MEM21001A	Replace watch batteries, capacitors and bands

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Verify watch condition and performance concerns with customer 1.2. Prepare written and verbal quotations 1.3. Agree with customer on recommended service procedures to remedy faults 1.4. Record and document repair process
2. Open and close watch cases	2.1. Determine need to open case for further testing 2.2. Select and use workshop tools and equipment appropriately 2.3. Open and close watch cases correctly

ELEMENT	PERFORMANCE CRITERIA
	2.4. Inspect parts and report and record results 2.5. Verify gasket condition and replace as required 2.6. Clean cases and bands as required during and after repair
3. Perform tests	3.1. Select appropriate tests for the type of quartz watch 3.2. Select and use appropriate workshop testing equipment 3.3. Test quartz watch output signals using industry-specific equipment 3.4. Assess mechanical condition including freedom of gear train, where applicable 3.5. Maintain testing equipment 3.6. Record test results
4. Analyse results and determine faults	4.1. Interpret test results correctly 4.2. Carry out further testing, as required, to locate faulty components 4.3. Confirm results against manufacturer specifications 4.4. Identify faults from test information 4.5. Evaluate, record and communicate recommended servicing requirements

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- using testing equipment (e.g. multimeter and quartz timing machines)
- analysing test results for current consumption and voltage
- solving problems
- replacing cells
- accessing and interpreting manufacturer service or technical guides
- communicating with relevant personnel
- replacing watch bands, straps or bracelets



**REQUIRED SKILLS AND KNOWLEDGE****Required knowledge**

Required knowledge includes:

- types of quartz watch construction and components
- function/operating principles of electronic quartz watches
- types of cells, power sources, capacitors and electronic storage units
- observation and inspection techniques
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to diagnose faults in quartz watches to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- select and perform appropriate tests
- use testing equipment
- analyse test results
- determine faults based on test results and visual inspection
- report most appropriate service procedures.

**Context of and specific resources for assessment**

- Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Record and document repair</b>	Record and document repair process may include:

<b>RANGE STATEMENT</b>	
<b>process</b>	<ul style="list-style-type: none"> <li>• accessing manufacturers' technical guides</li> <li>• prepare customer written quotation detailing faults</li> <li>• recommend most appropriate service procedure</li> <li>• estimate of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Tools and equipment</b>	<p>Tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• watch case opening and closing tools</li> <li>• hand tools (e.g. tweezers, screwdrivers and eyeglasses)</li> </ul>
<b>Tests</b>	<p>Tests may include:</p> <ul style="list-style-type: none"> <li>• acoustic, capacitive and inductive pick-ups/sensors</li> <li>• quartz crystal oscillating signals (32 KHz)</li> <li>• voltage, resistance and current consumption</li> <li>• output pulses (integrated circuits)</li> <li>• pulse generation of step motor</li> <li>• lower working limit</li> <li>• rate (e.g. capacitive and inhibition)</li> </ul>
<b>Types of quartz watch</b>	<p>Types of electronic quartz watches may include:</p> <ul style="list-style-type: none"> <li>• analog display</li> <li>• digital display</li> <li>• duo display</li> <li>• anadigi</li> <li>• calendar and/or moon phase</li> <li>• chronograph</li> <li>• perpetual calendar</li> <li>• alarm</li> <li>• kinetic</li> <li>• auto quartz</li> </ul>
<b>Workshop testing equipment</b>	<p>Workshop testing equipment may include:</p> <ul style="list-style-type: none"> <li>• quartz timing machines with acoustic and capacitive pick-up</li> <li>• inductive pick-up sensors</li> <li>• multimeters</li> <li>• variable voltage supplies</li> <li>• pulse generators</li> </ul>

**RANGE STATEMENT****Faulty components**

Faulty components may include:

- quartz crystal
- integrated circuits
- electronic circuits
- coils
- step motors
- gear train
- dial train
- dials and hands

**Unit Sector(s)****Unit sector**

Horology

**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	
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## MEM21006A Service quartz watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for quartz analog and digital display watches, including modules and case components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to watch repairers working in watch service and repair centres and jewellery stores and kiosks offering watch service and repair. It is a common servicing requirement for watch repairers and may extend, in some cases, to the work of service technicians.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM21005A	Diagnose faults in quartz watches
	MEM21002A	Perform watch movement exchange

<b>Prerequisite units</b>		
	MEM21001A	Replace watch batteries, capacitors and bands

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine servicing requirements and liaise with customer	1.1. Identify watch functions and features 1.2. Prepare written quotation and inform customer of watch condition and performance concerns 1.3. Outline recommended service procedures to be undertaken to remedy identified faults 1.4. Verify and agree servicing requirements with customer 1.5. Prepare watch for handover 1.6. Record and document repair process
2. Disassemble watch case and movement components for servicing	2.1. Establish appropriate working environment 2.2. Select and use workshop tools and equipment appropriately 2.3. Open and close watch cases correctly 2.4. Remove case movement and components without

ELEMENT	PERFORMANCE CRITERIA
	damaging or marking 2.5. Verify gasket condition and replace if required 2.6. Clean cases and bands, as required
3. Service watch case and movement components	3.1. Inspect condition of watch case and movement components 3.2. Confirm servicing requirements 3.3. Replace faulty or worn component parts 3.4. Clean components and parts 3.5. Inspect watch case and movement components for cleanliness and rectify imperfections/faults 3.6. Use correct tools and equipment for handling and servicing
4. Reassemble and test watch case and movement components	4.1. Reassemble watch case and movement components according to manufacturer specifications 4.2. Confirm correct assembly of gear train and other components 4.3. Use correct types and amounts of lubricant according to manufacturer specifications 4.4. Use tools and equipment appropriately taking precautions for correct reassembly 4.5. Verify/confirm watch functioning according to manufacturer specifications 4.6. Verify watch performance including rate testing and adjust, as required, according to manufacturer specifications

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- diagnosing and fault-finding quartz analog and digital watches
- dismantling and assembling quartz watch digital modules, movements, gear trains and sub-assemblies

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>• applying correct type and amount of lubrication</li> <li>• using quartz timing and testing equipment</li> <li>• communicating effectively</li> <li>• interpreting manufacturer technical guides</li> </ul>
<b>Required knowledge</b>
<p>Required knowledge includes:</p> <ul style="list-style-type: none"> <li>• quartz watch construction and components (i.e. analog, digital and duo displays)</li> <li>• quartz watch operating principles (e.g. analog and digital)</li> <li>• quartz watch lubrication techniques</li> <li>• watch case and band construction and components</li> <li>• client liaison techniques</li> <li>• power sources</li> <li>• power cells, batteries, capacitors and electronic storage units</li> <li>• occupational health and safety (OHS) regulations and procedures</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to service quartz watches to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• use correct disassembly/reassembly techniques</li> <li>• perform watch function and electrical performance testing</li> <li>• use appropriate watch movement/components cleaning techniques</li> <li>• apply lubrication techniques.</li> </ul>
<b>Context of and specific resources for</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in a simulated working environment. Access is required to real or</li> </ul>



<b>EVIDENCE GUIDE</b>	
<b>assessment</b>	<p>appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. <b>Bold italicised</b></p>

**RANGE STATEMENT**

wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Watch functions and features**

Watch functions and features may include:

- quartz oscillating stage
- dividing stage
- motor drive output pulses
- capacitive output signals
- current consumption
- pulse generation
- lower working limit test
- gear train freedom

**Record and document repair process**

Record and document repair process may include:

- extent and date of repair
- cost of replacement part
- time spent on procedure

**Appropriate working environment**

Appropriate working environment may include:

- suitable watchmakers' bench
- clean and orderly work area (precautions taken to minimise dust)
- adequate lighting and ventilation
- ergonomic chair with adjustable height

**Workshop tools and equipment**

Workshop tools and equipment may include:

- timing machine
- multimeter
- pulse generator
- watch repair hand tools
- case opening and closing tools
- cleaning media
- cleaning machines
- lubricants
- personal protective equipment

**Movement and case components**

Movement and case components may include:

- quartz crystal
- electronic circuits
- coils

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• mechanical gear train</li> <li>• liquid crystal displays</li> <li>• watch glasses</li> <li>• case back</li> <li>• bezel (rotating)</li> <li>• crown</li> <li>• pendant</li> <li>• pushbuttons</li> </ul>
<b>Watch performance/rate testing</b>	Watch performance/rate testing may include: <ul style="list-style-type: none"> <li>• current consumption according to manufacturer specifications</li> <li>• rate testing (e.g. +0.25 - 0.3 seconds/day)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM21007A Service complex quartz watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for complex quartz analog, digital and duo display watches, including chronographs and perpetual calendars with multiple step motors and ultrasonic step motor calendar driving systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to specialist repairers working in watch service and repair centres and jewellery stores where servicing and repairs on complex quartz watches, chronographs and perpetual calendars is offered.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM21006A	Service quartz watches
	MEM21005A	Diagnose faults in quartz watches

<b>Prerequisite units</b>		
	MEM21002A	Perform watch movement exchange
	MEM21001A	Replace watch batteries, capacitors and bands

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Identify watch functions and features 1.2. Prepare written quotation and inform customer of watch condition and performance concerns 1.3. Outline recommended service procedures to be undertaken to remedy identified faults 1.4. Verify and agree on servicing requirements with customer 1.5. Prepare watch for handover 1.6. Record and document repair process
2. Disassemble complex quartz watch cases, movements and	2.1. Establish appropriate working environment 2.2. Select and use workshop tools and equipment appropriately

ELEMENT	PERFORMANCE CRITERIA
components	2.3.Open watch cases correctly 2.4.Remove case components and movement without damaging or marking 2.5.Verify gasket condition and replace, as required 2.6.Clean cases and bands, as required
3. Service complex quartz watch case and movement components	3.1.Inspect condition of movement and case components 3.2.Confirm servicing requirements 3.3.Replace faulty or worn component parts 3.4.Clean and inspect watch case and components for cleanliness and rectify imperfections and faults
4. Reassemble and test complex quartz watches	4.1.Reassemble multiple step motors, perpetual calendar mechanisms, watch movement and case components 4.2.Perform work according to manufacturer guidelines and specifications 4.3.Confirm correct assembly and operation of gear train and perpetual calendar driving system 4.4.Use correct types and amounts of lubricant 4.5.Use specialist service tools, jigs and testing equipment 4.6.Verify watch functioning of calendar and chronograph mechanisms 4.7.Verify and adjust watch performance and rate testing 4.8.Perform resetting and zeroing and synchronising of chronograph and perpetual calendar displays

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- dismantling and reassembling complex quartz watches, chronographs and perpetual calendars

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>servicing, fault-finding and performance testing multiple quartz step motors</li> <li>re-programming or resetting integrated circuits and synchronising analog displays for quartz chronographs and perpetual calendars</li> </ul>
<b>Required knowledge</b>
<p>Required knowledge includes:</p> <ul style="list-style-type: none"> <li>quartz watch construction, components and operating principles, including calendars and motor drive systems</li> <li>service procedures for complex analog and digital quartz watches</li> <li>client liaison techniques</li> <li>fault-finding techniques for quartz watches</li> <li>performance testing equipment/procedures</li> <li>types of calendar displays</li> <li>service procedures to program and reset chronograph and perpetual calendar circuits</li> <li>occupational health and safety (OHS) regulations and procedures</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to service complex quartz watches to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>service multiple step motors in quartz chronograph and perpetual calendar watches</li> <li>fault-find complex quartz watches</li> <li>performance test complex quartz watches</li> <li>re-programming and resetting integrated circuits and synchronising analog displays for quartz chronographs and perpetual calendars.</li> </ul>

**EVIDENCE GUIDE****Context of and specific resources for assessment**

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

**Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.
- Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessment may be in conjunction with assessment of other units of competency where required.

**Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.



## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Complex quartz watch functions and features</b>	<p>Complex quartz watch functions and features may include:</p> <ul style="list-style-type: none"> <li>• chronograph</li> <li>• perpetual calendar</li> <li>• repeater</li> <li>• perpetual calendar with multiple step motors</li> <li>• ultrasonic step motor calendar driving systems</li> </ul>
<b>Record and document repair process</b>	<p>Record and document repair process may include:</p> <ul style="list-style-type: none"> <li>• extent and date of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Appropriate working environment</b>	<p>Appropriate working environment may include:</p> <ul style="list-style-type: none"> <li>• suitable watchmakers' bench</li> <li>• clean and orderly work area (precautions taken to minimise dust)</li> <li>• suitable lighting and adequate ventilation</li> <li>• ergonomic chair with adjustable height</li> </ul>
<b>Workshop tools and equipment</b>	<p>Workshop tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• timing machine</li> <li>• multimeter</li> <li>• pulse generator</li> <li>• watch repair and construction hand tools</li> <li>• case opening and closing tools</li> <li>• cleaning media</li> <li>• cleaning machines</li> <li>• lubricants</li> <li>• personal protective equipment</li> </ul>
<b>Case components</b>	<p>Case components may include:</p> <ul style="list-style-type: none"> <li>• watch glasses</li> <li>• case back</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• bezel (e.g. rotating)</li> <li>• crown (e.g. screwed)</li> <li>• pendant</li> <li>• pushbuttons (e.g. arbors and circlips)</li> <li>• gaskets</li> </ul>
<b>Watch performance/rate testing</b>	Watch performance/rate testing may include: <ul style="list-style-type: none"> <li>• current consumption (e.g. manufacture specifications)</li> <li>• pulse generation</li> <li>• lower working limit test</li> <li>• gear train freedom</li> <li>• types of quartz regulating systems (capacitive, inhibition and thermo-compensation)</li> <li>• adjust rate for various types of quartz watch (e.g. +0.25 - 0.3 seconds/day)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>	

## Competency field

<b>Competency field</b>	
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## MEM21008A Service mechanical watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for mechanical watches, including movements, sub-assemblies and components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to those working in watch service and repair centres and jewellery stores where service and repair are offered. The unit covers common servicing requirements for mechanical watches undertaken by all watch repairers. Work beyond normal servicing requirements is covered by <i>MEM21009A Inspect, diagnose, adjust and repair mechanical watches</i>.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Identify watch type, functions, construction and components 1.2. Carry out pre-repair tests to verify water-resistance, as required 1.3. Prepare written quotation and inform customer of watch condition, completeness and performance concerns 1.4. Outline recommended service procedures to be undertaken to remedy identified faults 1.5. Verify and agree on servicing requirements with customer 1.6. Prepare watch for handover 1.7. Record and document repair process
2. Disassemble watch, case and movement components for servicing	2.1. Establish appropriate working environment 2.2. Open and close watch cases correctly 2.3. Remove case components and movement sub-assemblies in correct sequence without damaging or marking 2.4. Verify condition of case gaskets and replace, as

ELEMENT	PERFORMANCE CRITERIA
	required 2.5.Clean watch case and band, as required
3. Service watch case, movement, sub-assemblies and components	3.1.Inspect condition of movement, sub-assemblies and case components 3.2.Confirm servicing requirements 3.3.Replace faulty or worn component parts/movement, sub-assemblies or case 3.4.Select appropriate cleaning methods and clean components 3.5.Inspect watch case and components for cleanliness and rectify imperfections and faults
4. Reassemble watch, movement and case components	4.1.Reassemble watch movement and case components according to manufacturer specifications 4.2.Assemble motion work and verify and adjust hand setting tension 4.3.Check and adjust component operation and watch functioning 4.4.Lubricate components and sub-assemblies according to manufacturer specification 4.5.Apply watch assembly inspections and precautions
5. Test and adjust watch function and performance	5.1.Verify function of watch movement and sub-assemblies 5.2.Correctly set up and operate mechanical watch timing machine and interpret readings 5.3.Verify watch performance and rate testing and adjust as required according to manufacturer specifications
6. Apply industry workshop standards to perform work	6.1.Use hand tools and equipment safely and correctly 6.2.Handle components without damaging or marking 6.3.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Required skills include:

- identifying various mechanical watches by function, escapement and quality
- dismantling and reassembling watch assemblies and movements
- applying correct amount and type of lubrication
- using service equipment (e.g. timing machine, cleaning machines)
- selecting and ordering replacement watch parts

### Required knowledge

Required knowledge includes:

- types of mechanical watches by function, escapement and quality
- function and operating principles of mechanical watches, including:
  - shock resistance system (e.g. Incabloc and Kif)
  - regulating systems (e.g. conventional, free sprung and Etachron)
  - mainsprings as generators of power motive force
  - gear train to transmit power
  - escapement to release power
  - oscillator to control the speed of release of power
  - winding and setting to wind watch and set hands to time
- dismantling/reassembling techniques of watch movements according to procedures and manufacturer guidelines
- watch cleaning methods
- band construction and components
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to service mechanical watches to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	<p>competently and consistently:</p> <ul style="list-style-type: none"> <li>• use correct dismantling and reassembling techniques (e.g. correct sequence for observations and fault diagnosis)</li> <li>• undertake function and performance testing (e.g. adjustment of rate, in-beat and amplitude)</li> <li>• use lubrication techniques (e.g. correct type, amount, application, cleanliness and without spilling)</li> <li>• safely clean watch movements and cases by machine and hand</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>



**EVIDENCE GUIDE****Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Watch type, function, construction and components**

Watch type, function, construction and components may include:

- manual wound
- shock-resistance system (e.g. Incabloc and Kif)
- regulating system (e.g. conventional, free sprung and Etachron)
- power reserve indicator
- mainspring
- gear train
- escapement
- oscillator
- winding and setting

**Record and document repair**

Record and document repair may include:

- extent and date of repair
- cost of replacement part
- time spent on procedure

**Appropriate working environment**

Appropriate working environment may include:

- clean bench and working area
- adequate lighting and ventilation
- tools and equipment are organised and in good condition
- ergonomic seating

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• ventilation</li> </ul>
<b>Case components and movement sub-assemblies</b>	<p>Case components and movement sub-assemblies may include:</p> <ul style="list-style-type: none"> <li>• glass and bezel (e.g. rotating)</li> <li>• case back and gaskets</li> <li>• crown, pendant, gaskets</li> <li>• balance and cock assembly</li> <li>• pallet, escapement components</li> <li>• barrel and mainspring assembly</li> <li>• gear train</li> <li>• winding and setting mechanisms</li> </ul>
<b>Inspect condition</b>	<p>Inspect condition may include:</p> <ul style="list-style-type: none"> <li>• originality of components</li> <li>• corrosion</li> <li>• cleanliness</li> <li>• wear</li> </ul>
<b>Cleaning methods</b>	<p>Cleaning methods may include:</p> <ul style="list-style-type: none"> <li>• conventional</li> <li>• ultrasonic</li> <li>• vibrational</li> <li>• hand cleaning</li> <li>• types of watch cleaning solutions used</li> <li>• precautions for handling and disposing cleaning solutions</li> </ul>
<b>Verify and adjust hand setting tension</b>	<p>Verify and adjust hand setting tension may include:</p> <ul style="list-style-type: none"> <li>• test for correct friction (e.g. second hand or train not reversing)</li> <li>• conventional cannon pinions</li> <li>• friction driving wheel</li> <li>• short off centre</li> </ul>
<b>Watch assembly inspections and precautions</b>	<p>Watch assembly inspections and precautions may include assessing:</p> <ul style="list-style-type: none"> <li>• winding and setting engagement, operation and lubrication</li> <li>• gear train end shake, backlash and lubrication</li> <li>• mainspring engagement, hooking, tension and lubrication</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• escapement action, operation e.g. pallet jump and lubrication</li> <li>• oscillator end shake, balance spring condition and correct amount lubrication</li> </ul>
<b>Mechanical watch timing machine</b>	<p>Mechanical watch timing machine may include:</p> <ul style="list-style-type: none"> <li>• Witschi watch expert or equivalent giving an indication of rate in seconds a day, beat error and amplitude</li> </ul>
<b>Watch performance and rate testing</b>	<p>Watch performance/rate testing may include:</p> <ul style="list-style-type: none"> <li>• in-beat under 0.5 milliseconds</li> <li>• rate adjustment +/- 10 seconds per day</li> <li>• amplitude minimum 220 - 270 degrees fully wound</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• timing machine</li> <li>• case opening/closing tools</li> <li>• oilers and oil pots</li> <li>• hand cleaning (e.g. pith, peg wood, rodico and solvents jar)</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	
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## MEM21009A Inspect, diagnose, adjust and repair mechanical watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers repair techniques for inspecting and evaluating the condition of mechanical watches, diagnosing problems, making repairs and adjusting mechanical watch movements and sub-assemblies. It builds on skills and knowledge required to service mechanical watches.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to fault-finding and repair work undertaken by a watch repair tradesperson on mechanical watches. Work would normally be undertaken in watch service and repair centres and jewellery stores where watch service and repair is offered.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM18001C	Use hand tools

<b>Prerequisite units</b>		
	MEM21008A	Service mechanical watches

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Establish servicing requirements	1.1. Identify watch construction, function and characteristics 1.2. Source manufacturer technical guidance information to determine correct tolerances and specifications 1.3. Prepare watch for handover 1.4. Record and document repair process
2. Inspect mechanical watches	2.1. Undertake inspections of watch movements in accordance with manufacturer tolerances and procedures 2.2. Make accurate observations of the condition and function of components and sub-assemblies 2.3. Remove and replace components and sub-assemblies in a sequence designed to accurately assess condition and faults during the process of dismantling and assembling

ELEMENT	PERFORMANCE CRITERIA
	2.4. Inspect lubrication quantity and condition
3. Diagnose faults in mechanical watches	3.1. Evaluate observations and watch performance characteristics to determine appropriate repair procedure 3.2. Analyse timekeeping performance using appropriate techniques and equipment 3.3. Make alterations in a logical sequence to diagnose faults
4. Repair and adjust mechanical watches	4.1. Select and use appropriate hand tools 4.2. Undertake dismantling and reassembling of watch movements according to industry standard procedures and manufacturer guidelines 4.3. Make precise corrections to sub-assemblies 4.4. Remove, dismantle, replace and reassemble sub-assemblies and components in correct order without damaging or marking 4.5. Select appropriate replacement components
5. Test and adjust watch function and performance	5.1. Verify and confirm function of watch movement and sub-assemblies 5.2. Verify watch performance and rate testing 5.3. Adjust, as required, according to manufacturer specifications 5.4. Repeat testing, as required, to confirm performance
6. Apply industry workshop standards to perform work	6.1. Use hand tools and equipment safely and correctly 6.2. Handle components without damaging or marking 6.3. Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- good manual dexterity
- assembling and dismantling in accordance with procedures and manufacturer

## REQUIRED SKILLS AND KNOWLEDGE

- guidelines of mechanical watches including movements
- undertaking inspection and adjustment of watch mechanisms and sub-assemblies, including:
  - escapement end shake and freedom checks
  - observation of gear train backlash
  - wear checks
- performing timekeeping analysis and adjustment techniques

### Required knowledge

Required knowledge includes:

- function and operating principles of mechanical watches:
  - mainspring
  - gear train
  - escapement
  - oscillator
  - winding and setting mechanisms
- procedures for fault-finding and inspection of watch mechanisms and sub-assemblies
- manufacturer specifications and tolerances for performance and timekeeping

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to inspect and evaluate the condition and performance of mechanical watches, diagnose faults and make repairs and adjustments to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- apply dextrous hand skills to manipulate components



<b>EVIDENCE GUIDE</b>	
	<p>and sub-assemblies</p> <ul style="list-style-type: none"> <li>• select and use appropriate bench tools when adjusting</li> <li>• interpret readings and make accurate observations to recognise faults</li> <li>• determine appropriate sequence to accurately assess condition and faults during the process of dismantling and assembly.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Watch construction, function and characteristics</b>	<p>Watch construction, function and characteristics may include:</p> <ul style="list-style-type: none"> <li>• mainspring variation of motive force</li> <li>• gear train freedom (e.g. end shakes, side shakes and backlash)</li> <li>• escapement operation performance</li> <li>• oscillator amplitude, balance spring positional changes and influences</li> <li>• winding and setting mechanisms</li> </ul>
<b>Condition and faults</b>	<p>Condition and faults may include:</p> <ul style="list-style-type: none"> <li>• end shakes, side shakes and clearances of operating components</li> <li>• oscillators balance spring condition, shock protection operation, condition and component replacement</li> <li>• functioning, clearances and safety action of the escapement system</li> <li>• mainspring and barrel assembly condition</li> <li>• gear train (e.g. pivot, pinions and bearings conditions - wear and corrosion)</li> <li>• winding and setting components (e.g. wear and end shake freedom)</li> <li>• lubrication including type, application, quantity and cleanliness</li> </ul>
<b>Timekeeping performance</b>	<p>Timekeeping performance may include:</p> <ul style="list-style-type: none"> <li>• regulating system components adjustment</li> <li>• balance spring condition (e.g. flat, concentric, beating evenly between curb pins)</li> <li>• beat error diagnosis and adjustment</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Sub-assemblies and components</b>	<p>Sub-assemblies and components may include:</p> <ul style="list-style-type: none"> <li>• balance and cock assembly (e.g. shock spring replacement)</li> <li>• escapement components (e.g. pallet and escape wheel)</li> <li>• barrel and mainspring assembly (e.g. barrel arbor, barrel wall hooking device )</li> <li>• gear train (e.g. observe backlash)</li> <li>• winding and setting mechanisms, including motion work and canon pinion</li> <li>• hand setting tension (e.g. cannon pinions and friction wheel)</li> <li>• shock-resistance system</li> <li>• calendar, winding system and other mechanisms</li> <li>• power reserve</li> </ul>
<b>Watch performance/rate testing</b>	<p>Watch performance and rate testing may include:</p> <ul style="list-style-type: none"> <li>• in-beat adjustment without movable stud holder</li> <li>• rate adjustment</li> <li>• amplitude evaluation of watches performance</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• timing machine</li> <li>• staking set</li> <li>• jewel press</li> <li>• eyeglass, screwdrivers and tweezers</li> <li>• case opening and closing tools</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21010A Service watch power generating systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for mechanical self-winding (automatic) watches and quartz watch power generating systems. It covers servicing of components, and adjusting and testing mechanisms for optimum performance.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to servicing work undertaken by a watch repair tradesperson on watch power generating systems. Work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Inspect watch condition and performance concerns 1.2. Prepare written and verbal quotations 1.3. Agree with customer on recommended service procedures to remedy faults 1.4. Identify mechanical self-winding or quartz generating system type 1.5. Prepare watch for handover 1.6. Record and document repair process
2. Disassemble and reassemble	2.1. Open and close self-winding or quartz generating watch cases correctly

ELEMENT	PERFORMANCE CRITERIA
self-winding or quartz generating mechanisms	2.2.Remove and replace case components, dial and hands, movements and sub-assemblies in correct sequence without damaging or marking 2.3.Verify condition of case pushbuttons, gaskets and replace, as required 2.4.Clean cases and bands, as required 2.5.Apply dismantling and assembly precautions
3. Service and adjust self-winding or quartz generating watch mechanisms	3.1.Inspect condition of self-winding or quartz generating watch mechanisms 3.2.Lubricate components and sub-assemblies according to manufacturer specification 3.3.Replace faulty or worn component parts 3.4.Clean self-winding or quartz generating watch mechanism components 3.5.Inspect self-winding or quartz generating mechanism for cleanliness and rectify imperfections or faults 3.6.Adjust self-winding or quartz generating mechanism components for correct operation, end shake and clearances
4. Test and adjust self-winding or quartz generating mechanism function and performance	4.1.Perform pre-service inspection and fault-finding of self-winding or quartz generating mechanism action, function and wrist sensitivity 4.2.Verify watch performance/rate testing and amplitude 4.3.Perform simulated wear and power generation tests, as appropriate
5. Apply industry workshop standards to perform work	5.1.Use hand tools and equipment safely and correctly 5.2.Handle components without damaging or marking 5.3.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Required skills include:

- inspecting and fault-finding of self-winding or quartz generating mechanisms (e.g. wear, function and actions)
- dismantling and reassembling of self-winding or quartz generating mechanisms
- dismantling and reassembling of watch movements according to procedures and manufacturer guidelines
- applying lubrication to self-winding or quartz generating mechanisms (e.g. correct application, type and amount)
- servicing of the barrel and mainspring slipping device
- running time performance testing of self-winding or quartz generating mechanisms (e.g. using automatic winding machine)

### Required knowledge

Required knowledge includes:

- types of self-winding or quartz generating watch
- identify and name the components of a self-winding or quartz generating mechanism
- inspection and fault-finding procedures of self-winding or quartz generating mechanisms (e.g. wear, function and actions)
- lubrication techniques of self-winding or quartz generating mechanisms (e.g. correct application, type, amount and cleanliness)
- function of the barrel and mainspring slipping device
- performance testing of self-winding or quartz generating mechanisms (e.g. using automatic winding machine - cyclomat)
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to service mechanical self-winding (automatic) watches and quartz watch power generating systems to industry standards, manufacturer specifications and in



<b>EVIDENCE GUIDE</b>	
	accordance with safety regulations and procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• dismantle and assemble self-winding or quartz generating mechanisms using correct techniques and precautions</li> <li>• inspect, fault-find and adjust self-winding or quartz generating mechanisms</li> <li>• conduct wear, performance and power generation testing</li> <li>• clean components and apply lubricants correctly.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment</li> </ul>

EVIDENCE GUIDE	
	of other units of competency where required.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>System type and construction</b>	<p>System type and construction may include:</p> <ul style="list-style-type: none"> <li>• mechanical self-winding</li> <li>• quartz watch power generation (e.g. kinetic and auto quartz)</li> <li>• types of construction (e.g. rotor, buffer, pedometer and case winding)</li> <li>• features of construction (e.g. single and two way winding)</li> <li>• performance characteristics (e.g. constant motive force)</li> </ul>
<b>Record and document repair process</b>	<p>Record and document repair process may include:</p> <ul style="list-style-type: none"> <li>• extent and date of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Dismantling and assembly precautions</b>	<p>Dismantling and assembly precautions may include:</p> <ul style="list-style-type: none"> <li>• sequence of inspection and adjustment of self-winding or quartz generating mechanism</li> <li>• verification of correct operation of oscillating weight, reversing wheel and mainspring slipping device</li> <li>• correct selection, application and amount of</li> </ul>

<b>RANGE STATEMENT</b>	
	lubrication for self-winding or quartz generating mechanism
<b>Faulty or worn component parts</b>	<p>Faulty or worn component parts may include:</p> <ul style="list-style-type: none"> <li>• oscillating weight ball bearings</li> <li>• rotor posts</li> <li>• reversing wheel pivots</li> <li>• clicks</li> <li>• slipping bridle</li> <li>• driving gear</li> <li>• friction clutch</li> <li>• generating rotor</li> </ul>
<b>Self-winding or quartz generating components</b>	<p>Self-winding or quartz generating components may include:</p> <ul style="list-style-type: none"> <li>• oscillating weights and rotor</li> <li>• transmissions, reverser wheels and wig wag</li> <li>• mainspring and barrel</li> <li>• slipping devices</li> </ul>
<b>Watch performance/rate testing</b>	<p>Watch performance and rate testing may include:</p> <ul style="list-style-type: none"> <li>• beat error diagnosis and adjustment</li> <li>• rate adjustment</li> <li>• amplitude</li> </ul>
<b>Wear and power generation tests</b>	<p>Wear and power generation tests may include:</p> <ul style="list-style-type: none"> <li>• machine simulation wear test (e.g. rotational machine)</li> <li>• testing by wrist wearing</li> <li>• kinetic voltage test</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• timing machine</li> <li>• mainspring winders</li> <li>• cyclomat</li> <li>• case opening and closing tools</li> </ul>
<b>Appropriate working environment</b>	<p>Appropriate working environment may include:</p> <ul style="list-style-type: none"> <li>• clean bench and working area</li> <li>• adequate lighting and ventilation</li> <li>• organised tools and equipment</li> <li>• ergonomic seating</li> </ul>

**RANGE STATEMENT****Clean and safe work environment**

Clean and safe work environment may be specified through:

- relevant legislation and regulations
- enterprise operating procedures
- 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21011A Service calendar and other dial indication mechanisms for watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for watches with different types or combinations of calendar and other dial indications, including date, day, month, year, moonphase, annual calendar, perpetual calendar, retrograde and power reserve indicators.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to dial indication servicing work undertaken by a watch repair tradesperson. This work is often performed in conjunction with major servicing on both mechanical and quartz watches received for repair. This work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
	MEM21010A	Service watch power generating systems
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements	1.1. Identify watch type, calendar construction and dial indicator components 1.2. Inspect condition and functions of calendar operation/dial indicator mechanisms 1.3. Prepare watch for handover 1.4. Record and document repair requirements

ELEMENT	PERFORMANCE CRITERIA
2. Dismantle and reassemble calendar and dial indication mechanisms	2.1. Select and use workshop tools and equipment appropriately 2.2. Open and close watch cases correctly 2.3. Dismantle and reassemble calendar and dial indication mechanisms according to design and construction constraints
3. Service calendar and dial indication mechanisms	3.1. Identify calendar and dial indications drive mechanism 3.2. Identify faults and repair or replace, worn or damaged component parts 3.3. Clean components using appropriate methods 3.4. Inspect correct fitting and function of all components 3.5. Verify sequencing and alignment of components during reassembly, including dial and hand fitting 3.6. Lubricate components according to manufacturer specifications
4. Verify calendar and dial indication mechanism operations	4.1. Test calendar and dial indications will not impact on watch performance, amplitude or timekeeping

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- dismantling and reassembling calendar and dial indication mechanism
- inspecting and diagnosing faults in calendar and dial indication mechanism
- applying correct type and amount of lubrication
- testing calendar and dial indication mechanisms, operation and synchronisation

#### Required knowledge

Required knowledge includes:

**REQUIRED SKILLS AND KNOWLEDGE**

- types of calendar watches
- types of calendar drive mechanism operation
- power reserve indicator construction and operation
- calendar/dial indications component part names
- lubrication techniques for calendar and dial indication mechanisms
- fault-finding and inspection techniques of calendar and dial indication mechanisms
- occupational health and safety (OHS) regulations and practices

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service calendar and dial indication mechanisms to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- dismantle, reassemble and lubricate calendar mechanisms
- service and fault-find calendar watches
- perform inspection and adjustment of calendar change mechanism
- synchronise dial indications with calendar change mechanism.

**Context of and specific resources for assessment**

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics



<b>EVIDENCE GUIDE</b>	
	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Watch type, calendar</b>	Watch type, calendar construction and dial

<b>RANGE STATEMENT</b>	
<b>construction and dial indication components</b>	<p>indication components may include:</p> <ul style="list-style-type: none"> <li>• date indications: <ul style="list-style-type: none"> <li>• day/date</li> <li>• day/date/month</li> </ul> </li> <li>• moon phase and year indicators</li> <li>• annual calendar</li> <li>• perpetual calendar</li> <li>• power reserve indicator</li> <li>• equation of time</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• date and extent of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Workshop tools and equipment</b>	<p>Workshop tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• hand tools (e.g. tweezers, screwdrivers and eyeglasses)</li> <li>• hand fitting pushers, stakes and presses</li> </ul>
<b>Calendar and dial indications drive mechanism</b>	<p>Calendar and dial indications drive mechanism may include:</p> <ul style="list-style-type: none"> <li>• creeping</li> <li>• semi-instantaneous</li> <li>• instantaneous</li> <li>• retrograde</li> <li>• rapid corrector</li> </ul>
<b>Correct fitting and functions</b>	<p>Correct fitting and functions may include:</p> <ul style="list-style-type: none"> <li>• end shake of components</li> <li>• clearances of moving parts</li> <li>• penetrations of calendar drive wheel mechanism, finger</li> <li>• spaces</li> <li>• safety features</li> <li>• calendar change operation at midnight</li> <li>• calendar action</li> <li>• rapid corrector engagement and operation</li> <li>• calendar day and date mechanisms</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21012A Service and repair mechanical watch oscillating systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing and repair techniques and procedures for balance staff replacement of mechanical watch oscillating systems and components. It also includes workshop techniques for removal of balance staffs, rollers and balance springs. Additionally, this unit covers techniques for inspection, assessment and adjustment of balance wheel trueness and poise, balance spring, in-beat, oscillator end shakes and servicing of shock protection devices.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to service and repair work undertaken by a watch repair tradesperson on watch oscillating systems. Work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify oscillator types	1.1. Identify oscillating construction types and components 1.2. Establish the performance characteristics of the watch oscillating system 1.3. Record and document repair requirements
2. Diagnose oscillator condition	2.1. Select and use workshop tools and equipment appropriately 2.2. Inspect oscillator components for condition, function, end shake and performance

ELEMENT	PERFORMANCE CRITERIA
	2.3.Record and report wear and damage to component parts 2.4.Determine appropriate repair process to rectify faults
3. Repair, replace and adjust oscillator components	3.1.Remove and reassemble balance complete and oscillator components using appropriate tools, equipment and techniques 3.2.Determine type and method of balance staff removal and replacement 3.3.Test security of replacement balance staff and oscillator components 3.4.Inspect condition and adjust balance wheel and oscillator components for correct operation 3.5.Determine type of roller and roller jewel and the method of removal and replacement procedures 3.6.Inspect, diagnose and adjust balance spring to achieve optimum performance and timekeeping 3.7.Inspect, service and replace components for shock protection devices fitted to mechanical oscillators
4. Test and adjust oscillator	4.1.Verify and confirm function of watch movement 4.2.Correctly set up and operate mechanical watch timing machine and interpret readings 4.3.Verify watch performance and timekeeping 4.4.Adjust in-beat and rate, as required, according to performance and design characteristics

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying types and grades of mechanical watch balance complete
- removing and replacing balance staffs and rollers
- truing balance wheels
- poising balance wheels (static)
- inspecting, diagnosing and adjusting balance springs

**REQUIRED SKILLS AND KNOWLEDGE**

- adjusting in-beat and rate
- setting up and operating mechanical watch timing machine

**Required knowledge**

Required knowledge includes:

- types and grades of balance wheel construction
- types of balance staffs construction
- types of balance spring construction
- types of rollers and roller jewels construction
- balance staff replacement techniques and workshop procedures
- performance characteristics of balance wheel completes
- balance spring adjusting techniques
- watch servicing procedures and techniques
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service, inspect and adjust mechanical watch oscillating systems, including balance staff replacement, to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- identify different types and grades of mechanical watch oscillating systems
- diagnose faults in mechanical watch oscillating systems
- inspect and repair faults in mechanical watch oscillating systems
- repair a mechanical watch with broken or worn balance staff

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>inspect and adjust oscillator components for optimum performance.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Oscillator construction types</b>	<p>Oscillating construction types may include:</p> <ul style="list-style-type: none"> <li>• roskoph</li> <li>• nickel</li> <li>• glycudur</li> <li>• chronometer</li> <li>• 2, 3, 4 arms</li> <li>• bi-metal compensating</li> <li>• annular</li> <li>• balance spring (e.g. flat and overcoil)</li> <li>• tourbillon</li> </ul>
<b>Performance characteristics</b>	<p>Performance characteristics may include:</p> <ul style="list-style-type: none"> <li>• timing, certified chronometer</li> <li>• effects of temperature, shocks, magnetism and position of wear</li> <li>• temperature compensation</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• extent and date of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Workshop tools and equipment</b>	<p>Workshop tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• hand tools</li> <li>• levers (e.g. balance spring)</li> <li>• roller removing tool</li> <li>• staking set</li> <li>• watchmaker's lathe</li> <li>• balance wheel truing tool</li> <li>• poising tool</li> <li>• figure of eight calipers</li> <li>• spirit lamp</li> <li>• presto roller jewel fitting tool</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Oscillator components</b>	<p>Oscillator components may include:</p> <ul style="list-style-type: none"> <li>• balance wheel</li> <li>• balance spring</li> <li>• balance staff</li> <li>• roller</li> <li>• roller jewel</li> </ul>
<b>Type of construction</b>	<p>Type of construction may include:</p> <ul style="list-style-type: none"> <li>• balance staff (e.g. friction fitted, riveted and screwed)</li> <li>• roller (e.g. single table, double table, incabloc and two piece)</li> <li>• roller jewel shape (e.g. D shape, triangular and elliptical)</li> <li>• balance spring (e.g. flat, overcoil, helical, spherical and conical)</li> </ul>
<b>Wear and damage</b>	<p>Wear and damage may include:</p> <ul style="list-style-type: none"> <li>• balance staff pivots bent, scored or worn</li> <li>• balance wheel out of true, damaged or enlarged hole</li> <li>• roller tables deformed or damaged</li> <li>• roller jewel cracked, chipped or missing</li> <li>• balance spring centred flat, at the cock and collet</li> </ul>
<b>Appropriate repair process</b>	<p>Appropriate repair process may include:</p> <ul style="list-style-type: none"> <li>• consideration of component cost and availability</li> <li>• replace balance complete</li> <li>• replace balance staff</li> <li>• repair or replace balance spring</li> <li>• repair or replace roller</li> <li>• dismantling and reassembling techniques</li> <li>• inspections adjustments of components</li> <li>• lubrication techniques, type and quantity</li> <li>• use of stop oil treatments (e.g. Epilame and Fixodrop)</li> </ul>
<b>Type and method of balance staff removal and replacement</b>	<p>Type and method of balance staff removal and replacement may include:</p> <ul style="list-style-type: none"> <li>• friction fit</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• riveted</li> <li>• screwed</li> <li>• turning rivet/hub on lathe</li> <li>• knock out staking set (e.g. platax tool)</li> <li>• grinding molfre tool</li> <li>• shock-resistance (e.g. incabloc)</li> </ul>
<b>Correct operation</b>	<p>Correct operation may include:</p> <ul style="list-style-type: none"> <li>• balance staff secure fitting/tightness</li> <li>• roller aligned and secure</li> <li>• balance wheel true</li> <li>• balance wheel static poised</li> <li>• balance spring stud location in-beat</li> <li>• balance spring adjusting</li> <li>• balance staff end shakes</li> </ul>
<b>Type of roller and roller jewel</b>	<p>Type of roller and roller jewel may include:</p> <ul style="list-style-type: none"> <li>• single table</li> <li>• double table</li> <li>• two piece</li> <li>• shock-resistance (e.g. incabloc)</li> <li>• D shaped, triangular or elliptical roller jewels</li> </ul>
<b>Shock protection devices</b>	<p>Shock protection devices may include:</p> <ul style="list-style-type: none"> <li>• operating principles</li> <li>• components (e.g. jewels, endstones, combined setting and shock spring)</li> <li>• types of construction (e.g. incabloc, Kif, Seiko, Citizen and Wyler)</li> </ul>
<b>Watch performance</b>	<p>Watch performance may include:</p> <ul style="list-style-type: none"> <li>• in-beat 0.5 ms</li> <li>• amplitude (e.g. minimum 220 - 270 degrees, variations in positional errors)</li> <li>• rate +/- 5 - 10 seconds a day</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	
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## MEM21013A Service, test and adjust watch escapements

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers inspecting watch escapement components and operation, observing and rectifying faults, replacing components and adjusting action to achieve optimum timekeeping performance for a watch escapements e.g. Swiss lever
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to service, testing and adjustment work undertaken by a watch repair tradesperson on watch escapements. Work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21012A	Service and repair mechanical watch oscillating systems
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect watch escapement condition	1.1. Identify escapement type and construction 1.2. Inspect escapement components and condition 1.3. Observe escapement action for faults 1.4. Perform and confirm safety test action 1.5. Record and document repair process
2. Repair, replace and adjust watch escapement	2.1. Adjust or replace components, as necessary 2.2. Adjust pallet stones for optimum performance

ELEMENT	PERFORMANCE CRITERIA
components	2.3.Adjust banking pins for optimum performance 2.4.Reconfirm safety test action
3. Test and adjust escapement function and performance	3.1.Verify and confirm escapement function and lubrication 3.2.Confirm escapement performance by assessing oscillator amplitude to manufacturer specifications 3.3.Reconfirm safety test action 3.4.Assess watch in various states of winding and position 3.5.Make adjustments, as necessary, to achieve performance within specification
4. Apply industry workshop standards to perform work	4.1.Use hand tools and equipment safely and correctly 4.2.Handle components without damaging or marking 4.3.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- performing inspections, diagnosing faults and adjusting lever escapements
- replacing and adjusting pallet stones
- assessing watch escapement performance and timekeeping

#### Required knowledge

Required knowledge includes:

- watch construction
- historic development and common types of escapements
- lever escapement function, operation, action, inspection and adjustment
- conduct escapement safety tests
- techniques for replacement/adjustment of pallet stones
- techniques for assessing watch escapement performance/timekeeping
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to inspect, adjust and repair watch escapements to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- identify faults in escapement condition and action
- rectify escapement action by replacement and adjustment
- correctly service/lubricate escapement
- performance test escapements.

#### Context of and specific resources for assessment

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

#### Method of assessment

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of



<b>EVIDENCE GUIDE</b>	
	<p>tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Equipment type and construction</b>	<p>Escapement type and construction may include:</p> <ul style="list-style-type: none"> <li>• recoil</li> <li>• frictional rest</li> <li>• detached</li> <li>• lever (Swiss or English)</li> <li>• co-axial</li> <li>• dual direct</li> <li>• chronometer (e.g. spring or pivoted detent)</li> <li>• cylinder</li> <li>• pin pallet</li> <li>• verge</li> <li>• duplex</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• semi-tangential</li> <li>• equidistant</li> <li>• circular</li> </ul>
<b>Escapement components and condition</b>	<p>Escapement components and condition may include:</p> <ul style="list-style-type: none"> <li>• escape wheel</li> <li>• lever</li> <li>• jewel pallet stones</li> <li>• fork</li> <li>• guard pin</li> <li>• roller and jewel</li> <li>• banking pins</li> <li>• alignment, division and end shake of escapement components</li> </ul>
<b>Safety test action</b>	<p>Safety test action may include:</p> <ul style="list-style-type: none"> <li>• clearance of horns</li> <li>• clearance of guard pin</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• extent and date of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• escapemeter</li> <li>• pallet stone warmer (e.g. spirit lamp and electric warmer)</li> <li>• shellac</li> <li>• banking pin adjusting tools</li> <li>• timing machine</li> <li>• staking tool</li> <li>• watch servicing hand tools (e.g. roller remover, escapement files, burnishers and levers)</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine,</li> </ul>

**RANGE STATEMENT**

	standardise, sustain)
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**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21014A Service mechanical chronograph watches

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for mechanical chronograph watches, including sub-assemblies and case components. It covers inspection and replacement of faulty components, testing, adjusting and lubrication procedures for chronograph mechanisms to ensure optimum performance and timekeeping.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to servicing work undertaken by a watch repair tradesperson on mechanical chronograph watches. Work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21011A	Service calendar and other dial indication mechanisms for watches
	MEM21010A	Service watch power generating systems
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	<p>1.1. Identify type of chronograph watch mechanisms and components</p> <p>1.2. Prepare written quotation and inform customer of watch condition and performance concerns, outlining recommended service procedures to be undertaken to remedy identified faults</p>

ELEMENT	PERFORMANCE CRITERIA
	1.3. Verify and agree on servicing requirements with customer 1.4. Prepare watch for handover 1.5. Establish appropriate working environment 1.6. Record and document repair process
2. Disassemble and reassemble chronograph watches	2.1. Open and close chronograph watch cases correctly 2.2. Remove and replace case components, dials and hands, movements and sub-assemblies in correct sequence without damaging or marking 2.3. Verify condition of case pushbuttons, operation and gaskets and replace, as required 2.4. Clean cases and bands, as required 2.5. Apply dismantling and assembly precautions
3. Service and adjust chronograph mechanisms	3.1. Inspect condition of chronograph components 3.2. Lubricate chronograph mechanism with correct type and amount according to manufacturer specifications 3.3. Replace faulty or worn components 3.4. Clean chronograph components 3.5. Inspect chronograph watch for cleanliness and rectify imperfections and faults 3.6. Adjust chronograph components for correct end shake, clearances and penetrations
4. Test and adjust chronograph watch function and performance	4.1. Perform pre-service inspection and fault-finding of chronograph action, function and depths 4.2. Verify and confirm dial and hand fitting, and casing up of chronograph 4.3. Verify watch performance and rate testing 4.4. Perform final adjustment and correction of recording and zeroing mechanism
5. Apply industry workshop standards to perform work	5.1. Use hand tools and equipment safely and correctly 5.2. Handle components without damaging or marking 5.3. Establish a clean and appropriate work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- diagnosing faults in complex mechanical watches
- dismantling/reassembling mechanical watch movements in accordance with procedures and manufacturer guidelines
- inspecting and adjusting chronograph watch mechanisms and sub-assemblies
- fault-finding and inspecting watch mechanisms and sub-assemblies
- performing timekeeping analysis and adjustment techniques
- selecting and applying correct amount of lubrication for chronograph mechanisms

### Required knowledge

Required knowledge includes:

- basic functions and operations of the chronograph or stop watch (e.g. start, stop and reset)
- identification of the component parts of a chronograph watch mechanism
- inspections and adjustments techniques of mechanical chronograph mechanisms
- dismantling/reassembling techniques for mechanical chronograph watches in accordance with procedures and manufacturer guidelines
- manufacturer specification and tolerances for lubrication, performance and timekeeping
- chronograph watch case construction, and pushbuttons and pendants servicing
- band construction and components
- occupational health and safety (OHS) regulations and procedures)

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to service mechanical chronograph watches to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• dismantle, assemble and clean chronograph watches using correct techniques and precautions</li> <li>• inspect, fault-find and adjust chronograph mechanisms</li> <li>• perform function and performance testing</li> <li>• perform chronograph dial and hand fitting</li> <li>• select and apply lubricants correctly.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>



**EVIDENCE GUIDE****Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Types of chronograph watch mechanisms**

Types of chronograph watch mechanisms may include:

- types (e.g. application of dial scale indications - tachymeter and telemeter)
- chronograph operating systems (e.g. pillar wheel actuated or cam controlled)
- features (e.g. minute record, hour record, automatic and split second)
- performance characteristics of chronograph watches

**Appropriate working environment**

Appropriate working environment may include:

- adequate lighting and ventilation
- clean bench and working area
- tools and equipment organised and in good condition
- ergonomic seating

**Record and document repair**

Record and document repair may include:

- date and extent of repair
- cost of replacement part
- time spent on procedure

**Dismantling and assembly precautions**

Dismantling and assembly precautions may include:

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>inspection of condition and adjustments of chronograph assembly functions</li> <li>verification of correct recording system operation (e.g. engagement, depthing, end shake, penetration)</li> <li>correct selection, application and amount of lubrication for chronograph mechanisms</li> <li>adjustment of timekeeping performance and balance amplitude during chronograph function</li> </ul>
<b>Chronograph components</b>	<p>Chronograph components may include:</p> <ul style="list-style-type: none"> <li>operating mechanism (e.g. single and double pusher action)</li> <li>clutch system for chronograph engagement</li> <li>transmission (e.g. minute and hour record)</li> <li>flyback and zeroing</li> </ul>
<b>Chronograph action</b>	<p>Chronograph action may include:</p> <ul style="list-style-type: none"> <li>start, stop, reset to zero</li> <li>hand zeroing</li> <li>indexing minute and hour record</li> </ul>
<b>Dial and hand fitting</b>	<p>Dial and hand fitting may include:</p> <ul style="list-style-type: none"> <li>hand fitting tools and supports</li> <li>alignments and synchronisation</li> </ul>
<b>Watch performance and rate testing</b>	<p>Watch performance and rate testing may include:</p> <ul style="list-style-type: none"> <li>beat error diagnosis and adjustment</li> <li>rate adjustment/positional errors</li> <li>amplitude (e.g. chronograph start - maximum variation &lt;40 degrees)</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>movement holders for operating chronograph functions</li> <li>timing machine</li> <li>rose cutters</li> <li>tools for removing chronograph driving wheel</li> <li>hand staking and fitting tools and supports</li> <li>case opening and closing tools</li> </ul>
<b>Clean and safe work</b>	Safe and clean work environment may be specified

<b>RANGE STATEMENT</b>	
<b>environment</b>	through: <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM21015A Perform precision watch timing and adjustment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers making fine adjustments to high-grade mechanical watches in order to achieve precision timing (chronometer performance).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to precision timing and adjustment work undertaken by a watch repair tradesperson on high-grade mechanical watches. Work would normally be undertaken in watch service and repair centres and jewellery stores where service and repairs are offered.</p> <p>This unit has been developed for watch service and repair apprenticeship training and the recognition of trade-level skills in watch servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM21013A	Service, test and adjust watch escapements

Prerequisite units		
	MEM21012A	Service and repair watch oscillating systems
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Identify high-grade mechanical watch characteristics 1.2. Prepare written quotation and inform customer of watch condition and performance concerns, outlining recommended service procedures to be undertaken to remedy identified faults and timekeeping accuracy 1.3. Verify and agree on servicing requirements with customer 1.4. Prepare watch for handover

ELEMENT	PERFORMANCE CRITERIA
	1.5.Record and document repair process
2. Analyse watch performance	2.1.Assess condition and ability of watch to achieve chronometer performance 2.2.Conduct performance analysis of mechanical watch 2.3.Adapt servicing techniques to meet manufacturer performance specifications (chronometer certified rating) 2.4.Assess oscillator and balance spring condition 2.5.Analyse positional errors in mechanical watch
3. Adjust mechanical watch performance	3.1.Adjust mechanical watch to minimise positional errors 3.2.Adjust mechanical watch to minimise variations in balance amplitude/performance/rate 3.3.Adjust oscillator and balance spring to minimise positional errors and perform dynamic poising 3.4.Repeat and confirm all adjustments
4. Test mechanical watch function and performance	4.1.Verify instantaneous watch performance and rate testing 4.2.Perform longitudinal testing to confirm watch performance 4.3.Determine intermittent timing faults and adjustments
5. Apply industry workshop standards to perform work	5.1.Use hand tools and equipment safely and correctly 5.2.Handle components without damaging or marking 5.3.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skill

Required skills include:

- setting up, using and interpreting readings of a mechanical watch timing machine
- conducting performance testing analysis for mechanical watches
- performing fine dexterous adjustments to oscillator components
- using tweezers to manipulate and adjust balance springs for optimum performance

**REQUIRED SKILLS AND KNOWLEDGE**

- conducting dynamic poising adjustment of balance wheel complete

**Required knowledge**

Required knowledge includes:

- types of high-grade mechanical watches by brand and complications
- characteristics of high-grade mechanical watch movements/components
- timekeeping accuracy for chronometers
- watch construction and components
- oscillator pivot friction and end shake adjustment
- influence of out-of-poised balance wheel
- influence of the escapement on timekeeping
- influence of the balance spring design/characteristics on timekeeping
- balance spring inspection and adjustment techniques
- performance testing procedures for mechanical watches
- factors affecting isochronism
- workshop procedures for conducting dynamic poising
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to adjust high-grade mechanical watches to achieve chronometer timekeeping to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- service high-grade mechanical watches to achieve original manufacturer timekeeping standards and specifications
- conduct watch performance testing (e.g. chronometer rating)

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>analyse and interpret results of watch performance testing</li> <li>adjust and rectify errors in watch oscillating system to achieve precision timing and chronometer performance +/- 4 to 5 seconds per/day.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### **High-grade mechanical watch characteristics**

High-grade mechanical watch characteristics may include:

- finish of components (e.g. bevelling, graining or level of polish)
- type of materials used for movement and case construction (e.g. non-magnetic alloys and precious metals)
- quality of components used (e.g. balance spring, escapement and balance wheel)
- certification chronometer
- brand name
- number of jewels

#### **Record and document repair**

Record and document repair may include:

- date and extent of repair
- cost of replacement part
- time spent on procedure

#### **Performance analysis**

Performance analysis may include:

- watch subjected to various testing positions (e.g. dial up, dial down, crown up, crown down, crown right and left)
- states of winding (e.g. partly wound, half wound and fully wound)
- temperature variation
- factors affecting isochronism (e.g. equal time of vibration)

#### **Oscillator and balance spring condition**

Oscillator and balance spring condition may include:

- static poise of balance wheel
- balance spring condition (e.g. concentric, flatness and beating evenly between curb pins)

<b>RANGE STATEMENT</b>	
<b>Dynamic poising</b>	<p>Dynamic poising may include:</p> <ul style="list-style-type: none"> <li>• set up and determine out-of-poise/balance wheel using a timing machine (e.g. amplitude &lt;180 degrees)</li> <li>• identify and locate point of adjustment</li> <li>• methods of adjustment (e.g. cutters and milling tools)</li> </ul>
<b>Confirm all adjustments</b>	<p>Confirm all adjustments may include:</p> <ul style="list-style-type: none"> <li>• ensure required accuracy is obtained and timekeeping is in accordance with manufacturer specifications (e.g. chronometer certified rating +/- 4 to 5 seconds per day)</li> </ul>
<b>Watch performance and rate testing</b>	<p>Watch performance and rate testing may include:</p> <ul style="list-style-type: none"> <li>• in-beat</li> <li>• rate adjustment</li> <li>• amplitude</li> <li>• effect or influence of escapement</li> <li>• temperature</li> <li>• effect of positional errors (e.g. isochronism)</li> <li>• effect of balance wheel poise</li> <li>• effect of balance spring</li> <li>• states of winding</li> </ul>
<b>Longitudinal testing</b>	<p>Longitudinal testing may include:</p> <ul style="list-style-type: none"> <li>• testing over extended time period by wearing or simulator machine (e.g. cyclomat)</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• mechanical watch timing machine</li> <li>• poising tools</li> <li>• balance wheel cutters</li> <li>• case opening and closing tools</li> </ul>
<b>Working environment</b>	<p>Working environment may include:</p> <ul style="list-style-type: none"> <li>• clean bench and working area</li> <li>• adequate lighting and ventilation</li> <li>• tools and equipment organised and in good condition</li> <li>• ergonomic seating</li> </ul>
<b>Clean and safe work</b>	Clean and safe work environment may be

**RANGE STATEMENT****environment**

specified through:

- relevant legislation and regulations
- enterprise operating procedures
- 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)

**Unit Sector(s)****Unit sector**

Horology

**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	
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## MEM21016A Install and set up clocks

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers setting up and assembling pendulum clocks on site. It also covers testing and making running adjustments to ensure correct function and performance.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to any clock repairer or vendor required to install, set up and test pendulum clocks on site, such as in domestic residences and commercial buildings. The most common application is usually a set-up and installation of new (long-case, wall or shelf) clocks or a set-up and installation after the return of serviced clocks to a customer's premises.</p> <p>Band: A</p> <p>Unit weight: 2 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Handle clocks, shipment and delivery	1.1. Verify and agree clock location requirements (environmental and architectural) with customer 1.2. Prepare the clock for shipment/transport 1.3. Arrange delivery, as required 1.4. Pack parts to avoid damage in transit 1.5. Complete clock handover with customer
2. Assemble and install clocks	2.1. Select and use tools and equipment appropriately 2.2. Unpack components and verify completeness 2.3. Install and stabilise clock case using appropriate methods and fixings 2.4. Assemble clock 2.5. Verify clock functions
3. Determine in-beat and adjust pendulum	3.1. Conduct in-beat assessment 3.2. Identify in-beat adjustment method

ELEMENT	PERFORMANCE CRITERIA
oscillating systems	3.3.Perform in-beat adjustment 3.4.Evaluate pendulum amplitude and action
4. Verify additional clock functions	4.1.Test and confirm correct striking and chiming sequence 4.2.Adjust, as required, to ensure correct tone and harmony 4.3.Set clock to time and confirm correct functioning of calendar and automatic night shut-off
5. Conduct basic clock regulation techniques	5.1.Set up and use timing equipment correctly 5.2.Verify pendulum rate correctly 5.3.Perform rate adjustments to achieve accurate timekeeping

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- packaging components
- handling and moving clock components and cases
- setting up and levelling clock cases
- using timing equipment
- adjusting the sound of the striking and chiming mechanisms
- interpreting timing test results
- making adjustments to achieve accurate timing and performance

#### Required knowledge

Required knowledge includes:

- types of clocks
- implications for correct set-up (e.g. wall, shelf, floor and specialty)
- wall and floor fixing methods
- tools and equipment for installation
- packaging methods and materials
- techniques to prevent transit damage

**REQUIRED SKILLS AND KNOWLEDGE**

- types of power sources used in clocks
- precautions when handling clock cases
- major sections of mechanical clocks
- components and function of clocks
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to install and set up clocks to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- safely package and handle clock components and cases
- set up and install pendulum clocks
- assemble clock components
- test and adjust clock functions and performance.

**Context of and specific resources for assessment**

- Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

**EVIDENCE GUIDE****Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.
- Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.
- Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.
- Assessment may be in conjunction with assessment of other units of competency where required.

**Guidance information for assessment**

Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Prepare the clock**

Prepare the clock may include:

- separating and packaging of components
- partial dismantling of clock (e.g. pendulum and weights)
- secure gong rods/hammers



<b>RANGE STATEMENT</b>	
<b>Clock handover</b>	<p>Clock handover may include:</p> <ul style="list-style-type: none"> <li>• informing customer of features and characteristics of clock</li> <li>• demonstrating winding and setting procedures for clock</li> <li>• informing customer of operation/switching of any automatic night silent/shut-off for chiming/striking mechanism</li> <li>• warranty information</li> <li>• recording date of installation</li> </ul>
<b>Tools and equipment</b>	<p>Tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• hand tools</li> <li>• drills</li> <li>• spirit level</li> <li>• power tools</li> <li>• safety equipment, including personal protective equipment</li> <li>• cleaning equipment</li> </ul>
<b>Verify completeness</b>	<p>Verify completeness may include:</p> <ul style="list-style-type: none"> <li>• all components checked against packing slip/component list</li> <li>• case parts, pendulum, weights and key</li> <li>• striking and chiming rods, bells or tubes</li> </ul>
<b>Appropriate methods and fixings</b>	<p>Appropriate methods and fixings may include:</p> <ul style="list-style-type: none"> <li>• suitable location/position identified (e.g. level, stable, drafts and people traffic)</li> <li>• wedges</li> <li>• floor and wall fixings</li> </ul>
<b>Clock functions</b>	<p>Clock functions may include:</p> <ul style="list-style-type: none"> <li>• pendulum in-beat (e.g. automatic beat)</li> <li>• striking and chiming</li> <li>• winding and setting</li> <li>• calendar-moon phase</li> </ul>
<b>In-beat assessment</b>	<p>In-beat assessment may include:</p> <ul style="list-style-type: none"> <li>• clock secure and level position</li> <li>• pendulum assembly complete and correctly attached</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>listen for evidence of even tick</li> </ul>
<b>In-beat adjustment method</b>	In-beat adjustment method may include: <ul style="list-style-type: none"> <li>friction crutch</li> <li>cam wheel</li> <li>bending crutch</li> <li>automatic beat adjuster</li> </ul>
<b>Rate adjustments</b>	Rate adjustments may include: <ul style="list-style-type: none"> <li>effect of changing pendulum length (shortening = gain, lengthening = loss)</li> <li>methods of adjusting bob position (e.g. screw thread)</li> <li>French devices (e.g. adjustable suspension)</li> <li>weight trays</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM21017A Service and repair clock timepieces

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for wall, floor or shelf clock timepieces that have a running time of eight days or thirty hours.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to clock repair work undertaken in clock service workshops. The unit does not cover servicing and repairs to complex clocks (e.g. clocks which are fitted with rack or count wheel striking mechanisms, complex escapements or oscillating mechanisms, rack or count wheel striking mechanisms, or clock chiming mechanisms). Where servicing or repairs are to be undertaken on these clocks or components appropriate higher level metal and engineering units should be selected.</p> <p>If after service and repair the clock is to be installed at the client's premises, <i>MEM21016A Install and set up clocks</i>, should be selected.</p> <p>Band: A</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Establish servicing requirements and liaise with customer	1.1. Identify clock origin and case and movement construction and function 1.2. Verify clock condition and performance concerns with customer 1.3. Prepare written and verbal quotations 1.4. Agree with customer on recommended service procedures 1.5. Prepare clock for handover 1.6. Record and document repair process 1.7. Source replacement parts from industry suppliers
2. Disassemble clock, case and movement	2.1. Establish appropriate working environment

ELEMENT	PERFORMANCE CRITERIA
components for servicing	2.2.Remove clock movements in sequence considering case design and construction 2.3.Select and correctly use appropriate hand and bench tools 2.4.Verify condition and completeness of clock case 2.5.Perform power release safely 2.6.Dismantle clock movement in correct sequence
3. Service and repair movement, sub-assemblies and components	3.1.Inspect movement, sub-assemblies and components, and identify condition and faults 3.2.Confirm servicing and repair requirements 3.3.Replace or repair faulty or worn component parts, movement or sub-assemblies 3.4.Use hand tools and equipment correctly for servicing and repair 3.5.Clean clock components at appropriate stages using cleaning and finishing methods 3.6.Verify condition of components after cleaning
4. Service clock cases	4.1.Verify completeness of clock case 4.2.Repair and replace missing or damaged components 4.3.Clean internals and refinish/refurbish exterior with appropriate materials and techniques
5. Reassemble clock movement and case components	5.1.Reassemble clock movement and case components 5.2.Assemble motion work and verify and adjust hand setting tension 5.3.Check and adjust component operations and clock functioning 5.4.Select and apply lubricants according to component design and estimated frictional load 5.5.Apply clock assembly inspections and precautions 5.6.Install and secure movement in case
6. Bench test and adjust clock functions	6.1.Verify/confirm function of clock movement 6.2.Set up, operate mechanical clock timing machine and interpret readings correctly 6.3.Verify clock performance and rate testing 6.4.Adjust rate according to performance and design characteristics
7. Apply industry workshop standards to perform work	7.1.Use hand tools and equipment safely and correctly 7.2.Handle components without damaging or marking 7.3.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying country of origin
- identifying various mechanical clocks by features, escapement and oscillator
- dismantling and reassembling clock assemblies and movements
- identifying and rectifying wear and faults in escapement, bearings, arbors, wheels and pinions
- replacing or repairing broken or damaged components
- safe handling of clock mainsprings, including using mainspring handling equipment
- correct lubrication including amount, type, cleanliness and point of application
- using service equipment (e.g. timing machine, cleaning machine, bushing tool, lathe
- determining and calculating train counts, such as vibrations per hour (VPH)

#### Required knowledge

Required knowledge includes:

- types of mechanical clocks by country of origin, function, escapement, quality
- function and operating principles of mechanical clocks
- dismantling and reassembling techniques of clock movements according to procedures and manufacturer guidelines
- clock cleaning methods
- procurement of replacement clock parts
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

**EVIDENCE GUIDE**

performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service and repair clock timepieces to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- dismantle and reassemble clock movement and components
- safely remove and replace clock mainsprings
- repair and re-finish worn arbor pivots
- re-centre and replace worn bearings (re-bushing)
- safely clean clock components using appropriate methods and media
- apply lubrication techniques (e.g. correct type and amount)
- perform function and performance testing (e.g. adjust escapements, beat error and rate).

**Context of and specific resources for assessment**

- Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

**Method of assessment**

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and



<b>EVIDENCE GUIDE</b>	
	<p>application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Clock origin, case and movement construction and function</b>	<p>Clock origin, case and movement construction and function may include:</p> <ul style="list-style-type: none"> <li>• clocks from all countries of manufacture</li> <li>• clocks manufactured during the 19<sup>th</sup> and 20<sup>th</sup> Centuries</li> <li>• clock cases made from timber, metal, natural stone and composite materials</li> <li>• movement components made from brass and steel</li> <li>• pendulum or balance oscillating systems</li> <li>• timepiece only mechanisms</li> <li>• motive force (e.g. mainspring or weight driven)</li> <li>• gear train for transmitting of power</li> <li>• escapement for release power</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>oscillator for controlling the speed of release of power</li> <li>winding (e.g. by key)</li> <li>time setting (e.g. by key or direct movement of hands)</li> </ul>
<b>Clock handover</b>	<p>Clock handover may include:</p> <ul style="list-style-type: none"> <li>informing customer of features and characteristics of clock</li> <li>demonstrating winding and setting procedures for clock</li> <li>inform customer of operation and switching of any automatic night silent, or shut-off for chiming or striking mechanism</li> <li>warranty information</li> <li>date of installation</li> </ul>
<b>Record and document repair process</b>	<p>Record and document repair process may include:</p> <ul style="list-style-type: none"> <li>extent and date of repair recorded</li> <li>tracking of subcontractors</li> <li>cost of replacement parts</li> <li>time spent on procedure</li> </ul>
<b>Appropriate working environment</b>	<p>Appropriate working environment may include:</p> <ul style="list-style-type: none"> <li>clean bench and working area</li> <li>adequate lighting and ventilation</li> <li>tools and equipment organised and in good condition</li> <li>ergonomic seating, including bench height</li> </ul>
<b>Condition and faults</b>	<p>Condition and faults may include:</p> <ul style="list-style-type: none"> <li>originality of components</li> <li>corrosion</li> <li>cleanliness</li> <li>wear</li> <li>damaged or failed components</li> </ul>
<b>Faulty or worn components</b>	<p>Faulty or worn components may include:</p> <ul style="list-style-type: none"> <li>barrel and mainspring (e.g. hooking, teeth and bearings)</li> <li>gear trains (e.g. bearings, pivots and pinions)</li> <li>pendulum escapements (e.g. pallets and escape wheels engagement drop, locking and</li> </ul>

**RANGE STATEMENT**

	<p>impulse)</p> <ul style="list-style-type: none"> <li>• oscillators pendulum type (e.g. rod, crutch engagement, suspension spring fittings and bob security)</li> <li>• oscillators balance type (e.g. balance spring, balance staff and roller)</li> <li>• winding mechanisms( e.g. key fitting, click, ratchet wheel and click spring)</li> <li>• setting hand tension or centre wheel friction</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• clock repairers' hand tools (e.g. tweezers, screwdrivers and eyeglasses)</li> <li>• clock mainspring winder</li> <li>• clock re-bushing tool</li> <li>• reamers and smoothing broaches</li> <li>• lathe</li> <li>• oilstones and burnishers</li> <li>• movement supports for clock movements</li> <li>• oilers and oil pots</li> <li>• cleaning brushes, peg wood, solutions and rinses e.g. solvents</li> <li>• clock timing machine (this includes any type of machine that provides frequency count or indication of daily rate)</li> </ul>
<b>Cleaning and finishing</b>	<p>Cleaning and finishing may include:</p> <ul style="list-style-type: none"> <li>• hand cleaning</li> <li>• conventional machine (rotational)</li> <li>• ultrasonic</li> <li>• vibrational finishing and polishing</li> <li>• types of clock cleaning solutions</li> <li>• precautions for handling and disposing cleaning solutions</li> <li>• safe practices for the use of polishing equipment</li> </ul>
<b>Verify and adjust hand setting tension</b>	<p>Verify and adjust hand setting tension may include:</p> <ul style="list-style-type: none"> <li>• test for correct friction (e.g. power to escape wheel)</li> <li>• adjustment of motion work friction</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Select and apply lubricants</b>	<p>Select and apply lubricants may include:</p> <ul style="list-style-type: none"> <li>• correct lubricants for escapements, bearings, barrels and mainsprings</li> <li>• techniques for lubricating</li> </ul>
<b>Clock assembly inspections and precautions</b>	<p>Clock assembly inspections and precautions may include:</p> <ul style="list-style-type: none"> <li>• gear train end shake, backlash, lubrication</li> <li>• mainspring engagement, hooking, tension, lubrication</li> <li>• escapement operation, depthing, lubrication</li> <li>• pendulum oscillator (e.g. amplitude, crutch engagement and suspension function)</li> <li>• balance oscillators (e.g. end shake and balance spring condition, correct lubrication)</li> </ul>
<b>Performance and design characteristics</b>	<p>Performance and design characteristics may include:</p> <ul style="list-style-type: none"> <li>• source of motive force</li> <li>• escapement type</li> <li>• oscillator and pendulum construction</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	
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## MEM21018A Service clock escapements and oscillating systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing techniques for inspecting, diagnosing faults and adjusting common clock escapements (e.g. deadbeat, recoil, cylinder and verge). It also covers techniques for servicing and replacement of different types of oscillating systems, including compound and compensating pendulums, torsional pendulum (e.g. 400 day and Atmos clocks) and platform escapement and floating balances.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to servicing work on clock escapements and oscillating systems undertaken in clock service and repair workshops.</p> <p>This unit has been developed for watch and clock service and repair apprenticeship training and the recognition of trade-level skills in watch and clock servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21017A	Service and repair clock timepieces
	MEM21013A	Service, test and adjust watch escapements
	MEM21012A	Service and repair watch oscillating systems
	MEM21009A	Inspect, diagnose, adjust and repair mechanical watches
	MEM21008A	Service mechanical watches
	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify escapement and oscillator type	<p>1.1. Identify clock escapements/oscillating systems and applications</p> <p>1.2. Establish the performance characteristics of the clock according to escapement and oscillating system</p>

ELEMENT	PERFORMANCE CRITERIA
	1.3.Record and document repair requirements
2. Diagnose clock escapements and oscillators	2.1.Select and use workshop tools and equipment appropriately 2.2.Inspect clock escapement and oscillators for correct function, engagement and performance 2.3.Record and report wear and damage to parts 2.4.Determine appropriate repair process to rectify faults
3. Repair and adjust clock escapements and oscillators	3.1.Remove and reassemble escapement/oscillators using appropriate tools, equipment and techniques 3.2.Determine theoretical length of replacement pendulum 3.3.Repair or replace escapement and oscillator components 3.4.Adjust escapement and oscillator components for correct operation
4. Service and adjust torsional pendulums	4.1.Remove and reassemble torsional pendulums and oscillator components using appropriate tools, equipment and techniques 4.2.Inspect torsional pendulum components and identify condition and wear 4.3.Repair and replace torsional pendulum 4.4.Adjust torsional pendulum for correct operation (in-beat)
5. Service and set up platform escapements	5.1.Remove and reassemble platform escapement using appropriate tools, equipment and techniques 5.2.Inspect platform escapement and identify condition/wear 5.3.Repair and replace platform escapement 5.4.Adjust platform escapement and correct dephasing with contrate wheel
6. Test and adjust rate	6.1.Verify/confirm function of clock movement 6.2.Correctly set up and operate mechanical clock timing machine and interpret readings 6.3.Verify clock performance and rate testing 6.4.Adjust rate, as required, according to performance and design characteristics



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying clock escapements and oscillators
- adjusting escapement function
- diagnosing faults
- adjusting rate
- setting up and operating timing machine

#### Required knowledge

Required knowledge includes:

- clock escapement types
- oscillator types
- performance characteristics of escapements and oscillators
- escapement adjusting techniques
- clock servicing procedures and techniques
- calculations and formulas for length of pendulum and geometry of escapements
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to service, inspect and adjust clock escapement and oscillating system to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate

Assessors must be satisfied that the candidate can competently and consistently:

<b>EVIDENCE GUIDE</b>	
<b>competency in this unit</b>	<ul style="list-style-type: none"> <li>• identify different types of clock escapements</li> <li>• diagnose faults in clock escapement action</li> <li>• repair faults in worn escapements</li> <li>• set up and adjust clock escapements for optimum performance</li> <li>• fault-find oscillating systems</li> <li>• calculate length of replacement pendulum</li> <li>• adjust rate of timepiece.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for</b>	Assessment processes and techniques must be culturally

**EVIDENCE GUIDE****assessment**

appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Clock escapements/oscillator systems**

Clock escapements/oscillator systems may include:

- verge
- recoil escapement
- deadbeat escapement
- cylinder
- platform (e.g. lever escapement and cylinder)
- simple pendulum
- compound pendulum
- compensating pendulum
- torsion pendulum
- floating balance
- suspension systems (e.g. spring blade, knife edge and silk)

**Record and document repair**

Record and document repair may include:

- extent and date of repair
- cost of replacement part
- time spent on procedure

**Adjust escapement and oscillator**

Adjust escapement/oscillator may include:

- condition amount of drop
- condition and extent of lockings
- condition and amount of impulse
- pendulum action and amplitude
- in-beat

**RANGE STATEMENT****Torsional pendulums**

Torsional pendulums may include:

- 400 day and Atmos clocks
- suspension spring

**Unit Sector(s)****Unit sector**

Horology

**Co-requisite units****Co-requisite units**


**Competency field****Competency field**

## MEM21019A Service and repair clock striking mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing of mechanical floor, wall and shelf clocks which are fitted with rack or count wheel striking mechanisms.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to servicing and repair work on mechanical clock striking mechanisms undertaken in clock service and repair workshops.</p> <p>This unit has been developed for watch and clock service and repair apprenticeship training and the recognition of trade-level skills in watch and clock servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM21017A	Service and repair clock timepieces

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Identify function and type of striking mechanism 1.2. Verify clock condition and performance concerns with customer 1.3. Prepare written and verbal quotations 1.4. Agree with customer on recommended service procedures 1.5. Prepare clock for handover 1.6. Record and document repair process 1.7. Source replacement parts from industry suppliers
2. Service and repair strike mechanisms	2.1. Remove and replace movement from case, considering case design and strike mechanism employed 2.2. Confirm operation of strike mechanism 2.3. Dismantle and reassemble strike components in correct sequence 2.4. Verify orientation of gear trains and strike detents 2.5. Inspect strike release, activation and sound generation, and identify wear, condition and faults 2.6. Confirm servicing and repair requirements

ELEMENT	PERFORMANCE CRITERIA
	2.7.Repair and rectify faults in strike components 2.8.Clean and reassemble mechanism and verify correct set-up, operation and performance 2.9.Select and apply lubricants to strike components
3. Bench test and adjust striking mechanism	3.1.Verify correct operation and function of striking mechanism 3.2.Verify clock operation over 24 hour period 3.3.Determine and rectify striking faults
4. Apply industry workshop standards to perform work	4.1.Use hand, bench tools and equipment safely and correctly 4.2.Establish appropriate working environment 4.3.Handle components without damaging or marking 4.4.Establish a clean and safe work environment

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying country of origin with respect to count wheel striking
- identifying various mechanical striking clocks by features (e.g. count wheel or rack)
- dismantling and reassembling striking clock assemblies and components
- identifying and rectifying wear and faults in striking mechanisms
- ensuring correct alignment of detents in striking mechanism and adjustment of function
- lubrication, including selecting and applying correct amount, type, cleanliness and point of application

#### Required knowledge

Required knowledge includes:

- types of clock striking systems
- difference between designs from various manufacturers
- application of gong rods, bells and hammers to achieve correct resonant sound

**REQUIRED SKILLS AND KNOWLEDGE**

generation

- fault-finding techniques for ensuring strike does not impact on clock operation
- dismantling and reassembling techniques for striking mechanisms
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service and repair clock striking mechanisms to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- dismantle and reassemble clocks with count wheel striking mechanisms
- dismantle and reassemble clocks with rack striking mechanisms
- perform operation and performance testing of striking clocks
- adjust striking clock mechanisms for correct operation and synchronisation with hands and sound generation and tonality
- apply lubrication techniques (e.g. correct type and amount)
- diagnose faults relating to strike mechanisms.

**Context of and specific resources for assessment**

- Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics



<b>EVIDENCE GUIDE</b>	
	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Function and type of striking</b>	Function and type of striking mechanism may

<b>RANGE STATEMENT</b>	
<b>mechanism</b>	<p>include:</p> <ul style="list-style-type: none"> <li>• motive force (e.g. mainspring or weight driven )</li> <li>• gear train (e.g. transmits power)</li> <li>• ways of producing striking sound (e.g. metal gongs, chime rods, bells and air bellows)</li> <li>• count wheel striking movements (e.g. European and American manufacture)</li> <li>• rack striking movements (e.g. European and American manufacture )</li> </ul>
<b>Record and document repair process</b>	<p>Record and document repair process may include:</p> <ul style="list-style-type: none"> <li>• date and extent of repair</li> <li>• cost of replacement parts</li> <li>• time spent on procedure</li> </ul>
<b>Operation of strike mechanism</b>	<p>Operation of strike mechanism may include:</p> <ul style="list-style-type: none"> <li>• hour struck corresponds with hands</li> <li>• release mechanism synchronised with hands</li> <li>• warning set-up correctly</li> <li>• function of release mechanism</li> <li>• sound generation (e.g. gongs, rods and hammer engagement)</li> </ul>
<b>Striking mechanism components</b>	<p>Striking mechanism components may include:</p> <ul style="list-style-type: none"> <li>• release mechanism</li> <li>• gathering pallet</li> <li>• detents</li> <li>• counting mechanism (e.g. snail and count wheel)</li> <li>• rack</li> <li>• gongs, chime rods and bells</li> <li>• hammers</li> </ul>
<b>Faults in striking mechanism components</b>	<p>Faults in striking mechanism components may include:</p> <ul style="list-style-type: none"> <li>• incorrect striking</li> <li>• continuous striking</li> <li>• striking mechanism stops clock or impacts on timekeeping</li> <li>• warning set-up</li> <li>• gong security</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• pin security</li> <li>• gathering pallet engagement with rack teeth, tightness and positioning</li> <li>• rack tail engagement position with snail</li> <li>• hammer inserts (e.g. condition - worn or aged)</li> <li>• security of gongs, rods and attachment to case</li> </ul>
<b>Correct set-up</b>	<p>Correct set-up may include:</p> <ul style="list-style-type: none"> <li>• synchronised strike release with hands</li> <li>• amount of warning</li> <li>• correct sequence</li> <li>• sound of strike</li> </ul>
<b>Lubricants to striking mechanism components</b>	<p>Lubricants to striking mechanism components may include:</p> <ul style="list-style-type: none"> <li>• correct lubricants for cams and detents</li> <li>• techniques for lubricating</li> </ul>
<b>Hand and bench tools and equipment</b>	<p>Hand and bench tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• clock repairers' hand tools (e.g. tweezers, screwdrivers and eyeglass)</li> <li>• universal shifter, sockets and spanners</li> <li>• pliers, end cutters and files</li> <li>• stakes for supporting removal or replacement of gathering pallet and cannon pinions</li> <li>• oilers and oil pots and greases</li> <li>• hand cleaning (e.g. pith, peg wood and rodico solvents jar)</li> </ul>
<b>Appropriate working environment</b>	<p>Appropriate working environment may include:</p> <ul style="list-style-type: none"> <li>• clean bench and working area</li> <li>• adequate lighting and ventilation</li> <li>• tools and equipment organised and in good condition</li> <li>• ergonomic seating, including bench height</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21020A Service and repair clock chiming mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers servicing of mechanical floor, wall and shelf clocks which are fitted with chiming mechanisms.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to servicing and repair work on mechanical clock chiming mechanisms undertaken in clock service and repair workshops.</p> <p>This unit has been developed for watch and clock service and repair apprenticeship training and the recognition of trade-level skills in watch and clock servicing and repair.</p> <p>Band: A</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
	MEM21019A	Service and repair clock striking mechanisms
	MEM21017A	Service and repair clock timepieces

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Establish servicing requirements and liaise with customer	1.1. Identify functions and types of chiming system 1.2. Verify clock condition and performance concerns with customer 1.3. Prepare written and verbal quotations 1.4. Agree with customer on recommended service procedures 1.5. Prepare clock for handover 1.6. Record and document repair process 1.7. Source replacement parts from industry suppliers
2. Service and repair chiming mechanisms	2.1. Remove and replace movement considering case design and chiming system employed 2.2. Confirm design and operation of the chime corrector mechanism 2.3. Determine service procedure for particular

ELEMENT	PERFORMANCE CRITERIA
	<p>movement design</p> <p>2.4. Inspect condition of chime release, activation and sound generation, and identify wear and faults</p> <p>2.5. Dismantle and clean chiming components</p> <p>2.6. Verify orientation of gear trains, strike and chime detents</p> <p>2.7. Confirm servicing and repair requirements</p> <p>2.8. Repair and rectify faults in chiming components</p> <p>2.9. Reassemble chiming mechanism and verify correct setup, operation and performance</p> <p>2.10. Select and apply lubricants to chime components</p>
3. Bench test and adjust chime functions	<p>3.1. Verify and confirm function of chiming mechanism</p> <p>3.2. Verify clock operation over 24 hour period</p> <p>3.3. Determine and rectify faults in chiming mechanism</p>
4. Apply industry workshop standards to perform work	<p>4.1. Use hand and bench tools and equipment safely and correctly</p> <p>4.2. Establish appropriate working environment</p> <p>4.3. Handle components without damaging or marking</p> <p>4.4. Establish a clean and safe work environment</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- identifying country of origin with respect to count wheel or locking plate chiming mechanism
- identifying various mechanical clocks by chiming features
- dismantling and reassembling chiming clock assemblies and movements
- identifying and rectifying wear and faults in chiming systems
- setting up chiming mechanisms for correct warning and chime corrector operation
- setting up and synchronising chime tunes for correct resonant sound generation
- lubrication including selecting and applying correct amount, type, cleanliness and

**REQUIRED SKILLS AND KNOWLEDGE**

point of application

**Required knowledge**

Required knowledge includes:

- types of clock chiming systems and chime correcting mechanisms
- differences between designs from various manufacturers
- application of gong rod, bells and hammers to achieve correct resonant sound generation
- dismantling and reassembling techniques for chiming mechanisms
- correct amount of warning and chime corrector operation
- fault-finding techniques for ensuring chime does not impact on clock operation
- occupational health and safety (OHS) regulations and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to service mechanical chiming clocks to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently:

- dismantle and reassemble clocks with chiming mechanisms
- fault-find clocks with chiming mechanisms
- repair/replace worn or damaged components
- perform correct set-up, operation and performance testing on chiming clocks
- adjust chiming clock mechanisms for correct operation/synchronisation with hands and sound generation/tonality
- apply lubrication techniques (e.g. correct type and amount)



<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• diagnose faults relating to chime mechanisms</li> <li>• verify operation of chime correctors.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in a simulated working environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### **Functions and types of chiming system**

Functions and types of chiming system may include:

- chiming clocks of various movement design (e.g. count wheel or locking plate, rack or combinations of control systems)
- long case and mantle clocks
- motive force (e.g. mainsprings or weights)
- gear trains (e.g. components of each train)
- chime release mechanism (e.g. control functions - chime and strike)
- chime and strike fans (e.g. control speed of trains)
- hand setting and synchronisation with chimes and strike
- winding systems in chiming clocks
- night shut-off switch types
- chime correcting mechanisms
- types of chimes by hammers and sequences for tunes (e.g. 4 or 8 hammer)
- tunes played (e.g. Westminster, St. Michaels and Whittington)
- chiming media (e.g. gongs, tubes and bells)

#### **Record and document repair process**

Record and document repair process may include:

- date and extent of repair
- cost of replacement parts
- time spent on procedure

#### **Design and operation of chiming corrector mechanism**

Design and operation of chiming corrector mechanism may include:

- double detent
- spring loaded catch
- rocking locking plate
- bell crank

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• pivoted detent</li> </ul>
<b>Inspect condition</b>	<p>Inspect condition may include:</p> <ul style="list-style-type: none"> <li>• originality of components</li> <li>• corrosion</li> <li>• cleanliness</li> <li>• wear</li> <li>• hand setting tension</li> <li>• function and safety of winding mechanism</li> <li>• gear train end shake/backlash/lubrication</li> <li>• mainspring engagement/hooks/tension/lubrication</li> <li>• adjustment of chime and striking functions</li> <li>• verification of chime corrector functions</li> <li>• synchronised chime release with operations of hands at the four quarters</li> <li>• amount of warning for chime train</li> <li>• strike release mechanism operation</li> <li>• sound of chimes and strike monitored</li> <li>• gong rods, bells, tubes alignment and security including attachment to case</li> <li>• hammer head inserts (e.g. condition - worn or aged)</li> </ul>
<b>Chime components</b>	<p>Chime components may include:</p> <ul style="list-style-type: none"> <li>• four quarter cam</li> <li>• lifter</li> <li>• chime flirt or detents</li> <li>• strike flirt or detent</li> <li>• chime locking plate</li> <li>• chime corrector</li> <li>• chime gear train (e.g. warning wheel)</li> <li>• ratio wheel (e.g. transmission)</li> <li>• chime pin barrel</li> <li>• gong rods, bells and tubes</li> <li>• hammers</li> </ul>
<b>Faults in chime components</b>	<p>Faults in chime components may include:</p> <ul style="list-style-type: none"> <li>• mounting security (e.g. gong rods, bells and tubes)</li> <li>• warning and locking pin security and detent mountings</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• hammer condition</li> <li>• worn arbors and bearings</li> <li>• broken or worn chime components</li> </ul>
<b>Correct set-up</b>	<p>Correct set-up may include:</p> <ul style="list-style-type: none"> <li>• synchronised chime release with hands</li> <li>• amount of warning</li> <li>• chime corrector operation</li> <li>• correct tune sequence</li> <li>• sounds of chime</li> </ul>
<b>Hand tools and equipment</b>	<p>Hand tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• clock repairers' hand tools (e.g. tweezers, screwdrivers and eyeglasses)</li> <li>• universal shifter, sockets and spanners</li> <li>• pliers, end cutters, files and levers</li> <li>• movement holders, stands and wall brackets</li> <li>• stakes for supporting removal/replacement of components (e.g. gathering pallet, cannon pinions and chime locking plate)</li> <li>• lathe for pivot and arbor repairs and finishing</li> <li>• clock bushing tool and replacement bushes</li> <li>• lubrication (e.g. oiler, oil pots and greases)</li> <li>• hand cleaning (e.g. pith, peg wood and rodico solvents jar)</li> </ul>
<b>Appropriate working environment</b>	<p>Appropriate working environment may include:</p> <ul style="list-style-type: none"> <li>• clean bench and working area</li> <li>• adequate lighting and ventilation</li> <li>• tools and equipment organised and in good condition</li> <li>• ergonomic seating, including bench height</li> </ul>
<b>Clean and safe work environment</b>	<p>Clean and safe work environment may be specified through:</p> <ul style="list-style-type: none"> <li>• relevant legislation and regulations</li> <li>• enterprise operating procedures</li> <li>• 5S housekeeping related principles and procedures (e.g. sort, straighten, shine, standardise, sustain)</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Horology
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	
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## MEM21021A Restore clockwork mechanisms

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers restoring and repairing clock components by manufacturing parts using hand skills and machine tools. It also covers servicing power equalisation systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to restoration and repair work on clock escapements and servicing of power equalisation systems undertaken in clock service and repair workshops. This work would normally be undertaken by specialist clock repairers. The unit includes restoration and repair work to antique clocks where parts are no longer available.</p> <p>For machine manufacture of clock components, <i>MEM21022A Manufacture watch and clock components</i>, should also be selected.</p> <p>Band: B</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21020A	Service and repair clock chiming mechanisms
	MEM21019A	Service and repair clock striking mechanisms
	MEM21017A	Service and repair clock timepieces
	MEM18001C	Use hand tools
	MEM09002B	Interpret technical drawing
	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify clock	1.1. Identify missing, damaged or worn parts

ELEMENT	PERFORMANCE CRITERIA
restoration requirements	1.2. Identify prior modifications and repairs, including non-standard or non-original components 1.3. Plan repairs in consideration of original clock design and manufacture 1.4. Record and document repair
2. Service and repair power equalisation devices	2.1. Identify fusee and stopwork device 2.2. Release mainspring power 2.3. Diagnose system faults 2.4. Replace fusee chains or cables 2.5. Set up fusee and stopwork systems
3. Produce clock parts by hand	3.1. Prepare working drawings and templates of replacement parts 3.2. Plan suitable method and sequence of production 3.3. Select materials suitable for manufacturing 3.4. Transfer designs and mark out templates and work pieces 3.5. Select appropriate hand tools to undertake process 3.6. Produce components by hand to required specifications 3.7. Conduct finishing, heat treatment, polishing of components 3.8. Verify function of manufactured components
4. Refinish and polish clock components	4.1. Select appropriate refinishing process to repair worn or corroded clock components 4.2. Refinish parts to replicate original finish 4.3. Adjust refinished components for correct function
5. Repair gears, wheels and arbors	5.1. Identify worn or damaged teeth 5.2. Fit, file and shape replacement teeth 5.3. Re-pivot arbors 5.4. Secure replacement part using appropriate fixing method 5.5. Test run with matched component

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE



## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- saw piercing
- transferring designs
- precision filing
- component fitting
- dismantling, reassembling and setting up power equalisation devices
- measuring components
- re-pivoting arbors

### Required knowledge

Required knowledge includes:

- clock design and manufacture
- gear forms (e.g. cycloidal and involute)
- gear terminology (e.g. pitch and root diameter)
- types and uses of files, including shapes and cuts
- jewellers saws and blades
- metal types and applications to clock components
- power equalisation devices and their function
- finishing and polishing techniques and media
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to restore clockwork mechanisms to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and

Assessors must be satisfied that the candidate can

<b>EVIDENCE GUIDE</b>	
<b>evidence required to demonstrate competency in this unit</b>	<p>competently and consistently:</p> <ul style="list-style-type: none"> <li>• manufacture by hand and fit replacement parts to specification</li> <li>• plan and conduct repairs to maintain originality of timepiece</li> <li>• dismantle, assemble and set up fusee systems.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Clock design and manufacture</b>	<p>Clock design and manufacture may include:</p> <ul style="list-style-type: none"> <li>• remaining faithful to original design and finish</li> <li>• accounting for value and provenance</li> <li>• maintaining originality of parts</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• date and extent of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Working drawings and templates</b>	<p>Working drawings and templates may include:</p> <ul style="list-style-type: none"> <li>• sketch or illustration by hand</li> <li>• photocopy original component then adhere to stock</li> </ul>
<b>Appropriate tools and equipment</b>	<p>Appropriate tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• files</li> <li>• burnishers</li> <li>• oil stones</li> <li>• jewellers saw</li> <li>• finishing papers</li> <li>• needle files</li> <li>• marking out equipment</li> <li>• lathe/drilling tailstock</li> </ul>
<b>Produce components by hand</b>	<p>Produce components by hand may include:</p> <ul style="list-style-type: none"> <li>• hands</li> <li>• pallets</li> <li>• striking and chiming levers</li> <li>• ratchet wheels</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• clickwork</li> <li>• taper pins</li> </ul>
<b>Heat treatment</b>	Heat treatment may include: <ul style="list-style-type: none"> <li>• annealing</li> <li>• hardening</li> <li>• tempering (bluing)</li> </ul>
<b>Refinishing process</b>	Refinishing process may include: <ul style="list-style-type: none"> <li>• filing</li> <li>• honing</li> <li>• graining and polishing</li> </ul>
<b>Clock components</b>	Clock components may include: <ul style="list-style-type: none"> <li>• arbors and pinions</li> <li>• clicks</li> <li>• pallets</li> <li>• screws</li> <li>• taper pins</li> </ul>
<b>Fixing method</b>	Fixing method may include: <ul style="list-style-type: none"> <li>• loctite</li> <li>• low melting solder</li> <li>• electronic soldering iron</li> <li>• spirit lamp</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	
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## MEM21022A Manufacture watch and clock components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers manufacturing watch and clock components using a range of general and specialist machines and engineering techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to the manufacture of replacement watch or clock components in a watch or clock repair and service centre. It applies when undertaking servicing and repair of watches and clocks and replacement parts are not available and there is a need to make a suitable replacement.</p> <p>This unit has been developed for watch and clock service and repair apprenticeship training and the recognition of trade-level skills in watch and clock servicing and repair. It may apply to post-trade training if not completed as part of a trade qualification.</p> <p>Band: B</p> <p>Unit weight: 6 points</p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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Prerequisite units		
	MEM21021A	Restore clockwork mechanisms
	MEM21020A	Service and repair clock chiming mechanisms
	MEM21019A	Service and repair clock striking mechanisms
	MEM21017A	Service and repair clock timepieces
	MEM18001C	Use hand tools
	MEM12023A	Perform engineering measurements
	MEM09002B	Interpret technical drawing
	MEM07005C	Perform general machining
	MEM06007B	Perform basic incidental heat/quenching, tempering and annealing

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish servicing requirements and liaise with customer	1.1. Identify the need for a replacement component 1.2. Verify availability of replacement parts and advise customer of the need to manufacture in-house 1.3. Prepare written and verbal quotations 1.4. Agree with customer on recommended procedures to remedy faults, including servicing requirements 1.5. Prepare watch or clock for handover 1.6. Record and document repair process 1.7. Source material for manufacture of parts
2. Plan and organise the project	2.1. Prepare working drawings of replacement parts 2.2. Plan suitable method of production 2.3. Select materials suitable for manufacture 2.4. Perform marking out of components 2.5. Select appropriate equipment and tools to undertake process
3. Produce components using a watch and clockmaker's lathe	3.1. Set up and mount the material to be turned in appropriate chuck 3.2. Select and prepare the appropriate cutting tool for the turning operation 3.3. Perform turning or drilling operation to produce replacement parts 3.4. Undertake measurements to task tolerances
4. Produce components using milling attachments on a clockmaker's lathe or bench-mounted mill	4.1. Set up and mount the material to be milled in appropriate fixture or chuck 4.2. Select and prepare the appropriate tool or cutter for milling operation 4.3. Perform milling operation to produce replacement parts 4.4. Undertake measurements to task tolerances
5. Produce wheels and pinions	5.1. Where appropriate, select the index head and appropriate index plate to produce the required tooth count 5.2. Set up gear blank in dividing head 5.3. Select appropriate gear cutter and mount in milling spindle ensuring cutter is on centre 5.4. Machine teeth to correct depth
6. Finish manufactured components	6.1. Cross out wheel to match original component



ELEMENT	PERFORMANCE CRITERIA
	6.2.Remove any burrs and finish with appropriate media 6.3.Carry out heat treatment to suit function of replacement part 6.4.Verify function of manufactured component

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- performing lathe operations on a watch and clockmaker's lathe
- performing milling operations using milling attachment on a watch and clockmaker's lathe or a bench mill
- selecting and preparing cutting tools
- planning of project sequence
- preparing working drawings of parts
- interpreting watch and clock drawings, manuals and other documentation that provide information of part design and tolerances
- measuring tolerances

#### Required knowledge

Required knowledge includes:

- typical materials used in watch and clock making
- types of watch and clockmakers' lathes and attachments
- lathe accessories and tooling
- setting up and safe operation of watch and clockmakers' lathes and attachments
- milling procedures
- occupational health and safety (OHS) regulations and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to manufacture clock and watch components to industry standards, manufacturer specifications and in accordance with safety regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- manufacture, finish and fit replacement watch or clock components to original tolerances
- select and use appropriate hand tools
- use lathes and accessories to turn watch and clock components
- perform milling operations using indexing and milling attachments on the lathe or bench-mounted milling machine to dimension and tolerances.

#### Context of and specific resources for assessment

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
- Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

#### Method of assessment

- Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.
- Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.
- Assessment methods must be by direct observation of tasks and include questioning on underpinning

**EVIDENCE GUIDE**

	<p>knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Replacement parts</b>	<p>Replacement parts may include:</p> <ul style="list-style-type: none"> <li>• wheels and pinions</li> <li>• arbors and pivots</li> <li>• click springs</li> <li>• ratchet wheel</li> <li>• setting lever springs</li> </ul>
<b>Record and document repair</b>	<p>Record and document repair may include:</p> <ul style="list-style-type: none"> <li>• date and extent of repair</li> <li>• cost of replacement part</li> <li>• time spent on procedure</li> </ul>
<b>Working drawings</b>	<p>Working drawings may include:</p> <ul style="list-style-type: none"> <li>• sketch or illustration by hand, including</li> </ul>

RANGE STATEMENT	
	dimensions
Appropriate chuck	Appropriate chuck may include: <ul style="list-style-type: none"> <li>• collet, three jaw and four jaw</li> </ul>
Appropriate cutting tool	Appropriate cutting tool may include: <ul style="list-style-type: none"> <li>• graver</li> <li>• cutting tool angle</li> <li>• parting off tool</li> </ul>

## Unit Sector(s)

Unit sector	Horology
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	
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## MEM21023A Plan, set up and operate horological workshop or service centre

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers planning, equipping and implementing a functional horological workshop or service centre to industry standards. This unit also covers basic administration procedures of a watch and clock service centre (e.g. quotations, security of goods held in trust, spare parts and repair administration procedures).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency applies to all those working in the horological service and repair industry (e.g. self-employed trade workers and workshop managers of large service centres). Applications may also be found in watch service centres and jewellery stores offering watch service and repair.</p> <p>This unit has been developed for watch and clock service and repair apprenticeship or post trade training and the recognition of trade-level skills in watch and clock servicing and repair.</p> <p>Band: B</p> <p>Unit weight: 4 points</p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan workshop layout	1.1.Prepare sketches of workshop layout 1.2.Plan work zones 1.3.Source suppliers of fixtures and furnishings
2. Source and purchase tools and equipment	2.1.Establish a budget 2.2.Determine major plant equipment for after sales service 2.3.Establish an adequate supply of tools for each workbench 2.4.Source suppliers of tools and equipment 2.5.Establish costs and initiate purchase
3. Set up workshop or	3.1.Purchase and set up furnishings and fittings

ELEMENT	PERFORMANCE CRITERIA
service centre	3.2.Install major plant bench tools and machinery 3.3.Implement ventilation, extraction and climate control systems 3.4.Establish repair administration systems 3.5.Establish spare parts systems and controls 3.6.Implement control and security measures for repair process
4. Prepare quotations and orders	4.1.Calculate profitability 4.2.Establish hourly rate 4.3.Correctly establish service and repair requirements 4.4.Determine availability and cost of spare parts 4.5.Provide customer with estimate 4.6.Prepare spare parts and other orders
5. Monitor workshop operations	5.1.Establish maintenance procedures for premises, major plant, equipment and tools 5.2.Review systems for efficiency and effectiveness 5.3.Implement improvements to operations

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- planning and organising
- selecting and implementing appropriate repair systems
- preparing quotes and estimates
- preparing orders
- controlling stocks of spare parts
- sketching
- accessing information
- preparing procedures
- monitoring and reviewing procedures and systems

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Required knowledge includes:

- horological workshop and service centre layouts, zoning of areas and other considerations
- occupational health and safety (OHS) issues for watch and clock trade
- handling and storage/disposal of solvents and other chemicals
- job control systems and methods of monitoring work flow
- horological tools and equipment/suppliers
- ergonomics, ventilation, dust control, lighting and climate control requirements for horological industry

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to plan and set up a horological workshop or service centre to industry standards, and monitor and review operations for efficiency and effectiveness in accordance with safety and other regulations and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently:

- plan horological service centre layout
- source and set up equipment
- set up repair systems and procedures
- monitor and review operations
- prepare quotes, estimates and orders.

#### Context of and specific resources for assessment

- Assessment may occur on the job or in an appropriately simulated environment. Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and information on workplace practices and OHS practices.
- Where applicable, reasonable adjustment must be



<b>EVIDENCE GUIDE</b>	
	<p>made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>

**RANGE STATEMENT**

regional contexts) may also be included.

<b>Workshop layout</b>	<p>Workshop layout may include:</p> <ul style="list-style-type: none"> <li>• orientation for adequate natural/artificial light</li> <li>• ventilation control</li> <li>• humidity and dust</li> <li>• appropriately positioned power points</li> <li>• consideration of work zone layout</li> </ul>
<b>Work zones</b>	<p>Work zones may include:</p> <ul style="list-style-type: none"> <li>• customer reception</li> <li>• administration</li> <li>• dismantling and reassembling</li> <li>• cleaning</li> <li>• polishing</li> <li>• storage (e.g. solvents, spare parts and technical guides)</li> </ul>
<b>Fixtures and furnishings</b>	<p>Fixtures and furnishings may include:</p> <ul style="list-style-type: none"> <li>• workbenches</li> <li>• chairs</li> <li>• lights</li> <li>• ventilation, extraction and dust suppression</li> <li>• climate control</li> <li>• desks</li> <li>• point of sale and cash control devices</li> </ul>
<b>Major plant and equipment</b>	<p>Major plant and equipment may include:</p> <ul style="list-style-type: none"> <li>• watch and clock servicing equipment</li> <li>• testing equipment, such as electronic testers for control of timing and water-resistance testing</li> <li>• machinery, such as watchmakers'/clockmakers' lathe</li> <li>• bench equipment, such as drill press and staking set</li> </ul>
<b>Supply of tools</b>	<p>Supply of tools may include:</p> <ul style="list-style-type: none"> <li>• comprehensive assortment of watch and clockmakers' hand tools</li> <li>• reference catalogues and publications</li> </ul>
<b>Ventilation, extraction and climate control systems</b>	<p>Ventilation, extraction and climate control systems may include:</p>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• air conditioning and ventilation</li> <li>• dust extraction and trapping</li> <li>• chemical storage, decanting areas and fume cupboards</li> </ul>
<b>Repair administration systems</b>	Repair administration systems may include: <ul style="list-style-type: none"> <li>• job envelope system</li> <li>• repair tracking software</li> </ul>
<b>Other orders</b>	Other orders may include: <ul style="list-style-type: none"> <li>• supplies</li> <li>• tools and equipment</li> <li>• consumables</li> <li>• materials and solutions</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	Horology
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	
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## MEM22001A Perform engineering activities

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the performance of technical aspects of engineering work in accordance with established engineering principles and practices.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to technical activities carried out within a range of engineering disciplines. It incorporates the personal and technical requirements to perform engineering activities where outcomes and performance measures are negotiated with appropriate personnel, technical experts and specialists.</p> <p>This unit only has application in qualifications that are not points based.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16006A	Organise and communicate information

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify and implement engineering practices	<p>1.1.Engineering practices applicable to engineering activities are identified.</p> <p>1.2.Factors, conditions and contexts integral to effective engineering practice are researched and evaluated.</p> <p>1.3.The application of management practices and regulatory/legal systems to engineering practice is researched and evaluated.</p> <p>1.4.Elements of engineering practices are incorporated into engineering activities.</p>
2. Negotiate, document and monitor outcomes and performance measures	<p>2.1.Technical experts and specialists are consulted as required.</p> <p>2.2.Engineering options are evaluated and ranked.</p> <p>2.3.Performance measures for processes and outcomes are negotiated with stakeholders and documented.</p>
3. Negotiate, develop	3.1.Work instructions are negotiated and documented

ELEMENT	PERFORMANCE CRITERIA
and document work instructions	with taskforce.
4. Perform hazard and risk analysis	4.1.Hazards and risks associated with project are analysed.
5. Monitor progress, respond appropriately	5.1.Progress is monitored and responded to in cooperation and consultation with stakeholders and taskforce.
6. Conclude engineering activities appropriately	6.1.Engineering activities are concluded in accordance with workplace and legislative requirements.
7. Evaluate career options and develop career development strategy	7.1.Career options are developed based on current engineering activities. 7.2.A portfolio or CV of current engineering activities that is also a framework for future engineering activities is developed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- research and evaluation
- review and maintenance of academic development, work experience, ethical practice, indemnity, negotiation, consultation and human relations with respect to the practice of engineering
- consultation with technical experts and specialists
- evaluation and ranking of engineering options for particular applications
- designing and planning documentation for particular applications
- documenting work instructions
- implementing occupational health and safety and environmental regulations, codes of practice and statutory requirements
- identifying and analysing hazards and risks
- monitoring and consultation with stakeholders and taskforce
- research and evaluation of engineering career options based on current engineering activities

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- political, social and environmental context and possible range of particular engineering activities
- the effect of government policy on industrial education and training, immigration for industrial labour/ skills, globalisation, the quality movement, JIT and competitive or lean manufacturing on a range of applications using jobbing, batch, mass or continuous production
- the significance, need for continual review and maintenance of academic development, work experience, ethical practice, indemnity, negotiation, consultation and human relations with respect to the practice of engineering
- the significance and applicability of strategic industrial management, financial management, workteams, supervision and control, industrial relations, OHS&E, enterprise based agreements, chemical registers, noise abatement, industrial law to particular industrial applications and work environments
- the application and affect of elements of engineering practice on particular engineering activities
- methods for evaluation and ranking of engineering options including the use of decision making and problem solving tools (eg. Kepler Trebor method)
- the significance of documented processes and outcomes performance measures in the context of client requirements, industrial, social, political and economic environments
- documented work instructions in the context of the objectives of the engineering activity
- negotiating principles
- risk assessment tools such as 'risk matrix' and 'Monte Carlo' risk assessment
- the significance of statutory requirements disaster management strategies
- long term environmental and sustainability issues associated with the engineering activity
- documentation and conclusion procedures
- relevance of current engineering activities to future career options
- the value of a portfolio in contributing to future career options in engineering

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the

**EVIDENCE GUIDE**

performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform engineering activities within one or more specified engineering disciplines. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing engineering activities or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Factors, conditions and contexts</b>	<ul style="list-style-type: none"> <li>Academic development, work experience, ethical practices, indemnity, negotiation, consultation and human relations</li> <li>Applicable local, regional, national and international economic, political and social contexts</li> </ul>
<b>Management practices</b>	Strategic industrial management, financial management, workteams, supervision and control.
<b>Regulatory/legal systems</b>	Industrial relations, OHS&E, enterprise based agreements, chemical registers, noise abatement, industrial law to particular industrial applications and work environments

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Management and organisation
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## MEM22002A Manage self in the engineering environment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing work ethically and competently, making judgements about work priorities and information requirements to achieve effective working relationships and engineering outcomes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the use of various self management techniques in the performance of engineering activities. Techniques may involve task and time management, effective communication strategies, document management, and business relations.</p> <p>This unit only has application in qualifications that are not points based.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16006A	Organise and communicate information

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Manage self	1.1.Manage own time and own processes in an engineering environment for planning and design purposes. 1.2.Manage learning opportunities in and outside the workplace. 1.3.Complete tasks / roles in a competent and timely manner.
2. Work effectively with team	2.1.Communicate effectively with others. 2.2.Recognise cultural diversity. 2.3.Use judgement and discretion as appropriate to the situation. 2.4.Work autonomously to procedures and guidelines. Develop and maintain trust and confidence of colleagues and clients/suppliers where appropriate. 2.5.Mentor others in specific areas of engineering focus.

ELEMENT	PERFORMANCE CRITERIA
	Accept appropriate responsibility.
3. Manage information	3.1. Locate and review relevant information on materials, products, processes or services including relevant legislation, codes and national standards. 3.2. Document processes and outcomes. Include OHS&E procedures.
4. Manage work priorities and resources	4.1. Prioritise competing demands to achieve personal, team and an organisation's goals and objectives. 4.2. Prepare, monitor and review work plans, programs and budgets. 4.3. Plan resource use to achieve targets.
5. Facilitate and capitalise on change and innovation	5.1. Work with others to introduce change. 5.2. Manage emerging challenges and opportunities.
6. Establish and maintain business relationships	6.1. Work in collaborative relationships with customers/suppliers. 6.2. Manage the procurement process.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- setting personal goals and plans
- completing allocated within time limits
- seeking feedback from internal and external sources
- providing clear and precise information to team members
- communicating in meetings
- using feedback to develop ways of improving performance
- accessing and using appropriate development opportunities
- team members are mentored in specific areas of engineering relevant to their work, where appropriate.
- obtaining all relevant legislation, statutory requirements and standards
- obtaining all relevant commercial documents

## REQUIRED SKILLS AND KNOWLEDGE

- documenting the processes and outcomes
- processing and filing the masters and file copies of documents
- setting priorities
- using technology appropriately to manage work priorities and commitments
- work plans, programs and/or budgets are prepared in accordance with organisational procedures.
- monitoring, reviewing and modifying work plans, programs and/or budgets
- achieving targets by the effective and efficient use of resources
- introducing changes smoothly and with minimal disruption
- communicating changes to be implemented
- preparing plans for the implementation of authorised changes
- providing regular and complete progress reports to clients/stakeholders/suppliers/regulators
- procuring materials/supplies/services in accordance with organisational procedures

## Required knowledge

Look for evidence that confirms knowledge of:

- techniques for ensuring that personal goals and plans reflect an organisation's plans and personal roles, responsibilities and accountabilities
- the way in which a person's performance acts as a role model for others
- ways in which personal goals are achieved and extended
- the importance and benefits of maintaining consistent personal performance
- the value of cultural diversity within the engineering team is recognised and the benefits
- internal and external sources of feedback on products, services and/or performance
- team members roles and responsibilities
- ways of gaining and using feedback to improve personal performance
- options for suitable professional development opportunities
- the role of mentor in the engineering team
- the mentoring process
- sources of relevant codes, standards, legislation and regulations
- the need and relevance for commercial information, including insurances and indemnities
- the procedures for documenting processes and outcomes
- the procedures for processing and filing master and file
- techniques for prioritising competing demands
- options for using various types of relevant technology and the ways they can be used efficiently and effectively to manage work priorities and commitments
- the procedures for preparing work plans, programs and budgets
- the authority responsible for authorising work plans, programs and budgets
- the procedures for modifying work plans, programs and/or budgets

**REQUIRED SKILLS AND KNOWLEDGE**

- human and physical resources available
- targets to be achieved
- techniques for optimising resource utilisation
- opportunities to introduce change
- the benefits of the proposed change
- the costs and risks associated with the proposed change
- those affected by change
- emerging challenges and opportunities in the area of engineering expertise
- opportunities to implement change and innovation
- reasons for implementing change and innovation
- strategies for implementing change and innovation
- customer needs
- clients/stakeholders/suppliers/regulators and their business relationships
- information required by clients/stakeholders/suppliers/ regulators
- the suppliers of materials/services/components/ equipment, etc.
- procurement procedures
- the authority responsible for authorising the procurement of materials/supplies/services
- commercial issues associated with the procurement process

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to manage self in the engineering environment. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with managing self in the engineering environment or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



<b>RANGE STATEMENT</b>	
<b>Engineering environment</b>	Refers to a real or simulated environment dealing in engineering practices/functions/services.
<b>Tasks/roles</b>	Will be involved in self-directed application of knowledge - have substantial depth of knowledge in some areas and a range of skills for work tasks, roles and functions.
<b>Cultural diversity</b>	Refers to all aspects of diversity within the working environment such as gender, age, physical ability, sexual preference, ethnicity and culture.
<b>Work autonomously</b>	May work autonomously under broad guidance; may supervise others and may guide teams.
<b>Appropriate responsibility</b>	May have responsibility for planning and managing the work of others.
<b>Relevant legislation codes and national standards</b>	Refers to all the legislation that occurs in the work place such as equal employment opportunity legislation, occupational health and safety legislation and industrial relations legislation.
<b>Document</b>	Applies to the time frame of the design development. Agreed processes of documentation will be required and applied.
<b>OHS&amp;E</b>	Occupational Health Safety and Environment recognizes that stakeholders in workplace activity include the workforce exposed to worksite conditions, materials and processes of the activity and the broader community exposed to environmental effects of the activity. Apply in accordance with organisational policies and statutory and regulatory requirements.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Management and organisation
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## MEM22007A Manage environmental effects of engineering activities

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers examining environmental issues and determine environmental strategies associated with engineering work.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a variety of environmental management techniques, including taking inventory of existing environmental condition, documenting/reporting initial assessment, determine and document/report stakeholder's expectations for improvements on initial condition against possibilities for improvement; developing, evaluating&amp;ranking strategies for sustainable development; implementing, monitoring&amp;evaluating strategies; applying environmental management techniques to a new or existing product, process, system or service.</p> <p>This unit only has application in qualifications that are not points based.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM16006A	Organise and communicate information

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine the existing environmental condition	1.1. Research, debate and report on case studies involving examination of environmental values. 1.2. Prepare an inventory of the existing environmental condition. 1.3. Record/report on the findings of the initial assessment.
2. Establish stakeholders' expectations	2.1. Determine expectations regarding each component of the environment. 2.2. Record and report on expectations for project/operation integration.
3. Review existing	3.1. Determine variations between expectations and the

ELEMENT	PERFORMANCE CRITERIA
environmental conditions against stakeholders' expectations	existing environmental conditions. 3.2.Establish the possibilities and options for improvement in the environment.
4. Develop and rank strategies to achieve sustainable development	4.1.Evaluates available options against assessment criteria to identify risks and priorities. 4.2.Develop an environmental report on strategies to implement the preferred options.
5. Implement strategies to achieve sustainable development	5.1.Implement strategies in consultation with appropriate stakeholders. 5.2.Collect and review data on implementation of strategies. 5.3.Evaluate progress and review strategies.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking debate on environmental values
- reporting on case studies involving examination of environmental values
- producing inventory of existing environmental conditions
- documenting the findings of the initial environmental assessment
- identifying stakeholders' environmental expectations
- integrating environmental expectations with the overall outcomes of the operation/project
- communicating expected outcomes to stakeholders
- documenting variations between expected and current environmental status
- implementing strategies for improving the environmental outcomes of the project/operation
- evaluating available options
- implementing selected sustainable development options
- developing environmental management plans
- monitoring the implementation of the environmental management plan
- collecting environmental data

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>reviewing and evaluating implementation strategies</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>environmental conditions of the workplace/process/ operation/procedure</li> <li>the procedures for documenting environmental conditions</li> <li>applicable environmental legislation and regulations</li> <li>the legislative/regulatory reporting and recording requirements</li> <li>the tests and testing procedures required to establish environmental conditions</li> <li>stakeholders' views on specific options for environmental improvement</li> <li>opportunities for integrating project/operation outcomes with environmental improvement options</li> <li>variations between expected and current environmental status</li> <li>options for improving the environmental status of the project/operation</li> <li>the costs/benefits of the identified options</li> <li>the concept of sustainable development</li> <li>options for sustainable development</li> <li>criteria for assessing the feasibility of available options</li> <li>the risks and priorities associated with sustainable development</li> <li>strategies to implement sustainable development options</li> <li>the procedures for communicating sustainable development options to stakeholders</li> <li>strategies to implement environmental development plans</li> <li>the data necessary to evaluate the implementation of the environmental management plan</li> <li>procedures for collecting and documenting environmental data</li> <li>benchmarks against which implementation strategies can be evaluated</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to manage the environmental effects of engineering activities. Competency in this unit cannot be</p>

<b>EVIDENCE GUIDE</b>	
	claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with managing the environmental effects of engineering activities or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Environmental values</b>	Biophysical values eg. clean air, soil, water, biodiversity, ecosystem sustainability, sustaining the quality of natural and artificial environments, both indoor and outdoor Socio cultural values
<b>Existing environmental conditions</b>	<p>Identification of environmental relations - mapping all the relations that will be used and affected by a particular activity in both space and time, analysing the resulting relational map for areas of intense impact, especially as a result of cumulative impacts; identification of physical, socio-cultural and economic conditions for life and for the existing or desired quality of life, identification of the socio-cultural values placed on the current environmental conditions; identification of both the negative and positive environmental impacts, the potential de-sustaining and sustaining aspects of the activity; identification of where engineering interventions and follow-up are possible</p>
<b>Environmental report</b>	<p>A description of the state of the environment, an assessment of the nature and consequence of impacts, identifiable trends, available and recommended actions, identification of responsibilities and potential change agents, cost of action; a critical review of the parameters of the environmental relations considered, the criteria by which they were evaluated, the process of developing responses and the achievement of the actions taken</p>



## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Management and organisation
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# **MEM22012A Coordinate resources for an engineering project or operation**

## **Modification History**

Release 1 - New unit. Replaces MEM22003A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the coordination of resources in accordance with operations or project plans and budgets formulated to meet business goals and strategic objectives.

## **Application of the Unit**

This unit applies to engineering projects or operations that have a significant engineering component. It is suitable for people with responsibility for resources and those pursuing technical qualifications and careers at engineering technician level.

Prior or concurrently developed experience in mathematics, computer packages and file handling, engineering plant, facilities and services, materials, methods and processes is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Contribute to operations or project planning and budgeting	1.1	Participate in policy and procedures development
		1.2	Review sustainability implications of resources, sourcing, processing, process waste, transport, distribution, life cycle and disposal
		1.3	Participate in planning for operations or project resourcing in the context of operations, project, strategic and business plans
		1.4	Participate in development of budgets
		1.5	Participate in development of performance indicators or parameters, monitoring and continuous improvement processes
		1.6	Participate in the development of resources information distribution and control systems, including the use of software systems
2	Evaluate supply chain relations	2.1	Identify supply value chain members and contribution to project or operation
		2.2	Assess supply agreements, quality and delivery parameters against performance indicators
		2.3	Employ value analysis of product or customer service costs
		2.4	Assess tender and contract documents for risk
		2.5	Assess supply chain communications for feedback on quality, supply chain efficiency and continuous improvement processes
3	Coordinate physical resources	3.1	Assess physical resource requirements and develop a resources distribution schedule consistent with the budget
		3.2	Coordinate efficient utilisation of physical resources
		3.3	Ensure compliance with work health and safety (WHS), regulatory and risk management requirements with particular emphasis on handling and use of resources

- |   |   |     |  |
|---|---|-----|--|
| 4 | Contribute to project or operation human resources management | 4.1 | Identify labour and skills requirements based on assessment of timetable and project or operational requirements |
|   |   | 4.2 | Program and communicate labour and skills to satisfy project or operational technical and budget requirements    |
|   |   | 4.3 | Organise labour and skill schedules to facilitate training   |
|   |   | 4.4 | Contribute to skills development and training arrangements   |
|   |   |     |  |
| 5 | Contribute to budget development and control                  | 5.1 | Participate in developing budgets in the context of business and strategic operations or project plans           |
|   |   | 5.2 | Control delegated expenditure and cash flow  |
|   |   | 5.3 | Record resources utilisation and costs, including those for maintenance of assets                                |
|   |   |     |  |
| 6 | Supervise and review resources delivery                       | 6.1 | Apply systems thinking, constraints and contingency management, and continuous improvement techniques            |
|   |   | 6.2 | Monitor and review supply chain and coordinate continuous improvements   |
|   |   | 6.3 | Monitor physical and human resources and performance indicators and coordinate continuous improvement processes  |
|   |   | 6.4 | Monitor budget and coordinate response to threats  |
|   |   | 6.5 | Monitor sustainability and coordinate responses in accordance with sustainability policy and procedures          |
|   |   | 6.6 | Monitor information and resources control system and implement continuous improvement                            |
|   |   | 6.7 | Employ software packages to achieve information handling, data processing, planning and control objectives       |

7	Report and document resources coordination	7.1	Report in accordance with procedures
		7.2	Maintain documentation on planning, supply chain analysis, resources requirements analysis, budgets, delivery, continuous improvement and training, WHS and regulatory requirements, and risk assessment

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- participating and communicating with others
- negotiating and seeking consensus in support of strategic objectives
- evaluating:
  - supply chain, quality, delivery and capability
  - tender and contracting processes and documents
- coordinating physical and human resources
- coordinating and controlling resource budgets
- monitoring, reviewing and improving resources delivery
- planning for operations or project resourcing in the context of operations, project, strategic and business plans
- participating, cooperating and negotiating required for dealing with customers, contractors, designers and production management
- determining take off quantities for 'bill of materials' from drawings, specifications and contracts
- reporting and documenting objectives, key performance indicators, timetables and progress

### Required knowledge

Required knowledge includes:

- typical sustainability implications for engineering projects or operations
- systems thinking, constraints and contingency management, and continuous improvement techniques
- procedures for preparing and monitoring project plans, business plans and budgets
- cost planning, cost-benefit analysis, life cycle costing, valuation and cost estimation procedures
- procedures for assessing implications of design on project implementation costs or

- manufacturability of product and maintainability of plant and process
- resources information distribution and control systems, including the use of enterprise resource planning (ERP) and materials resource planning (MRP) software
- planning and cost control software
- supply and value chain evaluation techniques, including contract, quality and delivery parameters
- engineering-related operating procedures associated with the use of resources
- financial impact of a variety of maintenance strategies on overall costs on typical tenders, contracts and law of contract provisions, relevant to engineering projects or operations
- ability to calculate quantities from drawings, specifications and contracts
- WHS requirements, including WHS Acts and regulations
- resources expenditure and cash flow control procedures
- procedures and requirements of financial records, including records of resources and costs for maintenance of assets

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to coordinate resources for an engineering project or operation within project plans and budgets. This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• participate, communicate, cooperate and negotiate strategic objectives, policy and procedures development</li> <li>• evaluate supply chain, quality, delivery, capability, tender and contracting processes and documents</li> <li>• coordinate and control physical and human resources and resource budgets</li> <li>• monitor, review and improve resources delivery</li> <li>• report and document resource planning and use.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> </ul>

	<ul style="list-style-type: none"> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Participate</b>	Participation includes the requirement to communicate, cooperate, negotiate and work with others in accordance with the operations or
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	project plans
<b>Software packages</b>	<p>Software packages may include:</p> <ul style="list-style-type: none"><li>• spreadsheets</li><li>• databases</li><li>• word processor</li><li>• presentation</li><li>• project management and cost control</li><li>• system control and data acquisition (SCADA), MRPII, MRPIII and ERP</li></ul>
<b>Value analysis</b>	<p>Value analysis is the determination of value-added, as defined by the ultimate customer at each step in the supply chain or production process or service provision. The value is often specified in contract documentation in terms of quality, cost, quantity and delivery schedule</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"><li>• WHS Acts and regulations</li><li>• relevant standards</li><li>• codes of practice from Australian and overseas engineering and technical associations and societies</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• state and territory regulatory requirements</li></ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to:</p> <ul style="list-style-type: none"><li>• plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance</li></ul> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"><li>• balanced scorecard</li><li>• current and future state mapping</li></ul>



	<ul style="list-style-type: none"><li>• measuring performance against benchmarks</li><li>• process improvement, problem solving and decision making</li><li>• data management, generation, recording, analysing, storing and use of software</li><li>• training for improvement systems participation</li><li>• technical training</li></ul>
<b>Manage constraints and contingencies</b>	<p>Contingencies arising during operations or improvement projects are responded to in the context of constraints. Contingencies may threaten operations or improvement projects and planning for contingencies may be essential to maintain resources, skilled labour and schedules. Each contingency will have constraints on possible solutions. These may be:</p> <ul style="list-style-type: none"><li>• financial, organisational, procedural or cultural constraints</li><li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li></ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Management and organisation

## Custom Content Section

Not applicable.

## MEM22013A Coordinate engineering projects

### Modification History

Release 1 - New unit. Replaces MEM22004A, but not equivalent.

### Unit Descriptor

This unit of competency covers the coordination of engineering projects within project plans and budgets. It includes monitoring and maintaining the project implementation plan, performance analysis and use of project management software.

### Application of the Unit

This unit applies to people with significant coordination and facilitation responsibilities for engineering or related projects. The projects will usually have fixed term or purpose and involve specific engineering-related tasks, such as installation and commissioning of plant, design of equipment or major overhauls.

The coordination role covered by the unit includes monitoring of engineering and other technical performance parameters against the project plan as well as monitoring of other project parameters that impact on engineering and technical compliance of the project. These include finance, accounting, budgeting and control, resourcing, tenders, contracts, work health and safety (WHS), risk management, human resources, and legal and regulatory requirements.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used,

a unit of competency. further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Review and confirm parameters of delegated project | <p>1.1 Review designs, drawings, standards and established implementation plan and schedule to establish scope of the engineering project</p> <p>1.2 Review budget and control measures for delegated project</p> <p>1.3 Review project management structure, functional team relationships, communications and reporting lines</p> <p>1.4 Review materials, logistics and services procurement requirements</p> <p>1.5 Review the need for appropriate technical and professional assistance</p> <p>1.6 Review physical resources requirements</p> <p>1.7 Review human resources and skills development requirements</p> <p>1.8 Review compliance requirements for project, including WHS requirements, codes of practice, regulations, standards, legal and other regulatory requirements, and enterprise procedures</p> |
| 2 | Coordinate implementation of delegated project     | <p>2.1 Assign and obtain team agreement to plans, communication arrangements, responsibilities, schedules and requirements</p> <p>2.2 Establish liaison arrangements with other functional groups</p> <p>2.3 Ensure efficient and documented arrangements for requests for further information (RFIs) from designers and other experts</p> <p>2.4 Confirm internal and external reporting requirements,</p>  |

- including content, schedule and sign-off arrangements
- 2.5 Confirm suppliers, contractors and delivery schedules, and any installation requirements
  - 2.6 Coordinate actions to overcome constraints and contingencies, including coordination with stakeholders and adjustments, if necessary, to plans and schedules
  - 2.7 Coordinate and monitor specialist and technical support services to meet schedules, budgets and performance requirements
  - 2.8 Maintain and monitor records of project tasks for accountability against objectives, schedule and budget
  - 2.9 Apply principles of continuous improvement to implementation
  - 2.10 Implement project management, resources control and budgeting software, when required
- 3 Report on outcomes
- 3.1 Record progress in accordance with procedures
  - 3.2 Supervise the completion of project, including sign-off and completion of required documentation of the project

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- coordinating technically complex engineering-related projects
- project management skills, including using resources control and budgeting software, as required
- reviewing, confirming and establishing parameters for project objectives, project plan, budget and scheduling related to tasks
- communicating, negotiating and reviewing with stakeholders throughout project duration
- coordinating and monitoring task schedules and resources; addressing contingencies and constraints, continuous improvement, problem solving and decision making; and adjusting short-term planning and rescheduling, as necessary

- implementing systems thinking and concurrent engineering, as appropriate
- project planning and scheduling, including:
  - working within or establishing a project management structure
  - establishing functional team relationships, communications and reporting lines
  - ensuring compliance with business plans, financial objectives, budgets and customer brief
  - incorporating WHS and other regulatory requirements
- establishing accountabilities and responsibilities (including recording and reporting) for:
  - scheduling and implementation of project tasks
  - physical and financial resources and budget
  - the use of professional services and contractors
  - maintaining records of trades and industry contacts and sources of expert advice
  - records of procedures and regulatory compliance
  - personal and team skills development
  - maintaining task schedules, Gantt charts and other planning tools and resources
  - procedures for addressing contingencies and constraints, continuous improvement, problem solving and decision making, and adjusting short-term planning and rescheduling as necessary
  - organisational procedures for compliance with WHS, codes of practice, and other legislative requirements, environmental and social obligations, and ethical practice
  - risk management procedures

## Required knowledge

Required knowledge includes:

- engineering and technology knowledge appropriate to the project
- context of project, including:
  - customer-supplier relationships
  - regulatory requirements and environment
  - materials resourcing and labour and skills supply arrangements
  - market and competitive environment
- human resources and skills development procedures and options for skill needs typical of engineering projects
- typical budget and control measures for engineering-related projects, including:
  - audit
  - tenders
  - contracts
  - schedules
  - budget categories and items:
    - personnel
    - materials

- equipment procurement and maintenance
- contractors
- logistics
- security
- requirements for and functions of technical documentation, graphics and specifications, meeting procedures, records and minute taking
- WHS Acts and regulations relevant to engineering projects
- risk management procedures, isolation and notification procedures in the event of irregularities or accident
- systems thinking, contingency and constraints management
- conflict resolution, problem solving and decision making

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to coordinate an engineering project This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• review, confirm and establish project objectives, plans and schedules</li> <li>• identify technical and engineering requirements of project from drawings, customer briefs, contracts and other appropriate sources</li> <li>• identify and manage stakeholders, including customers, suppliers, contractors and regulatory agencies</li> <li>• manage for contingencies and non-conformances</li> <li>• cooperate, communicate and negotiate effectively with stakeholders.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to</li> </ul>

	<p>work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Personal responsibilities</b>	<p>Personal responsibilities within the project may be defined by:</p> <ul style="list-style-type: none"> <li>• role specification and delegations</li> <li>• workplace agreement or Award</li> <li>• negotiation with clients and/or supervisors</li> <li>• contracts</li> <li>• legal or regulatory obligations</li> </ul>
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	<ul style="list-style-type: none"> <li>• professional and ethical considerations</li> <li>• agreed operational or project requirements</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• environmental protection and planning law</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Stakeholders</b>	<p>Relevant stakeholders may include:</p> <ul style="list-style-type: none"> <li>• teams</li> <li>• contractors</li> <li>• support professionals and teams</li> <li>• technicians</li> <li>• functional groups</li> <li>• customers</li> <li>• suppliers</li> </ul>
<b>Records of project</b>	<p>Records of project may include:</p> <ul style="list-style-type: none"> <li>• tenders and contracts</li> <li>• schedules</li> <li>• personnel</li> <li>• resource allocations and financial management procedures</li> <li>• standard operating procedures, including maintenance procedures</li> <li>• WHS committee minutes and action</li> </ul>



	<ul style="list-style-type: none"> <li>• risk management and mitigation</li> <li>• documentation and records of current safe work methods statements (SWMS), material safety data sheets (MSDS), work permits, standards and codes of practice</li> <li>• audits</li> <li>• meetings and communications</li> <li>• graphics and specifications</li> </ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to:</p> <ul style="list-style-type: none"> <li>• plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance. It may include techniques, such as: <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul> </li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers</li> <li>• professional and technical support for specific technologies and equipment</li> <li>• professional services for: <ul style="list-style-type: none"> <li>• finance, accounts and tax</li> <li>• insurance and legal,</li> <li>• training and human resources</li> </ul> </li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial, organisational, procedural or culture constraints</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Management and organisation

## **Custom Content Section**

Not applicable.

# **MEM22014A Coordinate engineering-related manufacturing operations**

## **Modification History**

Release 1 - New unit. Replaces MEM22005A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to coordinate, monitor and maintain engineering-related manufacturing operations, including the coordination of purchasing, scheduling of materials and resources, achievement of budget with control of processes, physical resources, maintenance of operations and assets, performance analysis and process improvement, work health and safety (WHS) and risk management.

## **Application of the Unit**

This unit applies to people with coordination and facilitation responsibilities for significant manufacturing operations.

Where the planning, scheduling and purchasing is done in an engineering or manufacturing organisation following lean principles, it is recommended that appropriate competitive systems and practices units of competency also be selected.

The unit applies where the coordination role involves application of engineering skills and knowledge to ensure safe, effective and efficient manufacturing and can include specific engineering-related tasks, such as installation and commissioning of plant, design of equipment and major overhauls.

The coordination role of the unit includes monitoring engineering and other technical performance parameters against the project plan as well as monitoring other project parameters that impact on engineering and technical compliance of the project. These include finance, accounting, budgeting and control, resourcing, tenders, contracts, WHS, risk management, human resources, and legal and regulatory requirements.

For coordination skills for time-defined engineering projects see unit MEM22013A Coordinate engineering projects.

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM14091A	Integrate manufacturing fundamentals into an engineering task

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element.
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## Elements and Performance Criteria

1	Develop the production plan	1.1	Coordinate development of, or obtain, demand forecast
		1.2	Participate in preparation of production plan in consultation with relevant stakeholders to meet quality, demand and delivery timelines within capacity and budget constraints
		1.3	Coordinate preparation of purchasing schedules
		1.4	Coordinate preparation of production schedules, including allowances for scheduled maintenance and any required shutdown periods
		1.5	Coordinate development of risk management and contingency procedures
		1.6	Review production plan with relevant stakeholders and adjust, as necessary
		1.7	Coordinate development of key performance indicators (KPIs) and monitoring procedures with relevant stakeholders
		1.8	Incorporate professional and technical assistance, as

required

- |   |  |     |   |
|---|--|-----|---|
| 2 | Coordinate the implementation of the production plan | 2.1 | Allocate responsibilities for purchasing and detailed scheduling, including communication of priorities and KPIs  |
|   |  | 2.2 | Coordinate materials and product flow and transfer operations to meet plan requirements, including buffer and emergency stocks, warehousing, stores and logistics |
|   |  | 2.3 | Monitor quality and process control procedures  |
|   |  | 2.4 | Coordinate and monitor physical, human and financial resources, and budget to achieve production plan   |
|   |  | 2.5 | Review and monitor information and reporting procedures to stakeholders   |
|   |  | 2.6 | Address systems constraints and contingencies and adjust short-term planning and reschedule, as necessary   |
|   |  |     |   |
| 3 | Monitor operational performance                      | 3.1 | Review actual indicators against KPIs   |
|   |  | 3.2 | Review manufacturing operations against production plan and other KPIs  |
|   |  | 3.3 | Participate in continuous improvement procedures, including lean operation principles and procedures, where implemented   |
|   |  | 3.4 | Monitor preventative and breakdown maintenance and review impact on operational performance   |
|   |  | 3.5 | Monitor implementation of risk management procedures during non-conformances and adjust, as required, in accordance with organisational procedures                |
|   |  | 3.6 | Report progress against production plan in accordance with procedures   |
|   |  | 3.7 | Provide documentation, data entry and analysis, as required   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying equipment and process capacity from information supplied by designers and suppliers
- developing production schedule demand forecast from information supplied by customers, distributors, and sales and marketing departments
- preparing master production, schedule or project plan
- detailed operations planning, scheduling, production control and contingency measures that take into account:
  - facilities
  - services
  - plant and tooling
  - enterprise resource planning (ERP) software
  - process layout
  - use of automation
  - product manufacturability
  - asset maintainability
- preparing purchasing schedules and coordinating material supplies
- complying with WHS and regulations, codes of practice, standards and risk assessment
- coordinating manufacturing operation to be consistent with business plans and legal and regulatory requirements, and coordinating systems maintenance of manufacturing operation following improvement procedures
- use of software, such as ERP, system control data acquisition (SCADA) and spreadsheets, where installed
- coordinating manufacturing operations to schedule and priority
- maintaining quality and process control procedures
- coordinating problem solving and decision making, short-term planning and rescheduling to meet constraints and contingencies, as necessary
- maintaining records, reporting and documenting in accordance with procedures

### Required knowledge

Required knowledge includes:

- manufacturing management systems
- forecasting, scheduling and production control procedures
- production systems, including assembly and process layouts, material and product flows, automation and control systems
- WHS requirements, codes of practice, regulations, standards, regulatory requirements, risk

management, current safe work methods statements (SWMS), material safety data sheets (MSDS) and work permits

- budgeting, costing and control measures
- quality and process control measures
- asset maintenance techniques and management options
- continuous improvement procedures
- problem solving and decision making, systems thinking, contingency and constraints management as applied to manufacturing
- requirements for and functions of technical documentation, graphics and specifications
- sustainability implications of manufacturing operations, products and processes, including social, environmental, resources and economic implications
- reporting and documenting procedures used in manufacturing, including role of standard operating procedures, engineering drawings and process control charts

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to coordinate, monitor and maintain an engineering-related manufacturing operation, including purchasing, scheduling of materials and resources and priorities. This includes working individually and as part of a team and recognising and complying with normal organisation control procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• prepare production or project plan in consultation with relevant stakeholders to meet WHS, quality, demand and delivery requirements within capacity and budget constraints</li> <li>• apply procedures to ensure compliance of manufacturing operations with WHS, environmental and other regulatory requirements</li> <li>• review and monitor facilities and services, including:               <ul style="list-style-type: none"> <li>• plant, tooling and software</li> <li>• process layout</li> <li>• use of automation and automation safety</li> <li>• product manufacturability and asset maintainability</li> <li>• compliance requirements of WHS and regulations, codes of practice, standards, risk assessment and registration requirements for manufacturing plant.</li> </ul> </li> </ul>

<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



<b>Relevant stakeholders</b>	<p>Relevant stakeholders may include:</p> <ul style="list-style-type: none"> <li>• team</li> <li>• organisation functional groups</li> <li>• support professionals and licensed technicians</li> <li>• customers and suppliers</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Records</b>	<p>Records may include:</p> <ul style="list-style-type: none"> <li>• forecasts, schedules and budgets</li> <li>• records of operations, production quantities, quality and supply performance</li> <li>• process, resources and budget control measures</li> <li>• communications, graphics and specifications</li> <li>• tenders, contracts and schedules</li> <li>• personnel, resource allocations and financial management procedures</li> <li>• standard operating procedures, including maintenance procedures</li> <li>• records of procedures and legislative compliance</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring or devices with high current or voltages above extra low voltage</li> </ul> </li> <li>• professional support for engineering research, calculations and technologies <ul style="list-style-type: none"> <li>• professional services in non-engineering related areas, such as: <ul style="list-style-type: none"> <li>• finance, accounts and tax</li> <li>• insurance and legal</li> </ul> </li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• training and human resources</li> </ul>
<b>Continuous improvement procedures</b>	<p>Continuous improvement procedures may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Contingencies arising during operations or improvement projects will have constraints on possible solutions. These may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisation procedural or culture</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Lean manufacturing</b>	<p>Lean manufacturing uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness</p>
<b>Software options</b>	<p>Software may be employed for forecasting, scheduling performance analysis/modelling and may include:</p> <ul style="list-style-type: none"> <li>• ERP</li> <li>• SCADA</li> </ul>

	<ul style="list-style-type: none"><li>• spreadsheets</li></ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Management and organisation

## Custom Content Section

Not applicable.

# **MEM22015A Source and estimate engineering materials requirements**

## **Modification History**

Release 1 - New unit. Replaces MEM22006A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to locate and approve a materials source and estimate materials requirements against a specification or bill of materials for engineering-related operations. This includes consideration of quantities, quality and capacity of suppliers to supply in accordance with a supply plan.

## **Application of the Unit**

The unit applies to sourcing and estimating within an engineering operation or along a value chain and can be applied to individual or team-based work. It is suitable for people working in engineering or related industries in planning, purchasing or quantity surveying functions.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Participate in planning and budgeting for materials resourcing in engineering operation or project	1.1	Participate in planning for materials resourcing in the context of operations, project, strategic and business plans and budgets
		1.2	Contribute to management processes, such as costing and value engineering, feasibility studies, cost-benefit and break even analysis, consideration of contract law pertaining to supply arrangements and life cycle costing
		1.3	Evaluate sustainability implications of materials and components being sourced
		1.4	Participate in the selection or development of materials information systems
		1.5	Review suitability of software packages for materials estimation and sourcing and related purposes
2	Estimate quantities	2.1	Consult with operations and project teams regarding their materials needs
		2.2	Estimate quantities against operations or project specifications, drawings and bill of materials documents
3	Contribute to the development of supply chain relations	3.1	Contribute to supply chain requirements, evaluation and management
		3.2	Assist in developing tender and contract documents
4	Locate source and confirm material suppliers	4.1	Locate source and evaluate materials suppliers against specifications
		4.2	Evaluate supply agreements, quality and delivery parameters against operation or project requirements
		4.3	Coordinate approval of samples, testing and certification in accordance with specification requirements
		4.4	Confirm or recommend suppliers according to enterprise procedures

5	Monitor and review materials and supply chain	5.1	Participate in development of performance indicators or parameters for materials supply chain
		5.2	Consult, negotiate and cooperate with suppliers in relation to supply chain efficiency improvements
		5.3	Provide feedback on quality, efficiency and continuous improvement processes to supply chain members and internal stakeholders
		5.4	Identify and monitor work health and safety (WHS) and regulatory requirements related to materials supply, transport, handling, storage and processing
		5.5	Monitor sustainability of sourced materials and coordinate responses in accordance with sustainability policy and procedures
		5.6	Apply systems thinking, constraints and contingency management, as necessary, and continuous improvement techniques
6	Report and document outcomes	6.1	Provide reports on material sourcing in accordance with procedures
		6.2	Maintain documentation on estimations, sources of supply, supply chain analysis performance, continuous improvement and training, WHS and regulatory requirements, and risk assessment

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- planning for materials resourcing
- estimating quantities, sourcing and evaluating materials suppliers against operations or project, specifications, drawings and bill of materials
- cooperating, communicating and negotiating effectively within team and functional groups, customers and suppliers
- monitoring and evaluating purchasing budget, expenditure and cash flow, sourcing of

- materials, sustainability implications, supply agreements and suppliers for quality, capacity and flexibility, conformance to regulatory requirements and test procedures
- using materials sourcing and planning software packages
  - contributing to organisational management processes and materials supply chain management
  - developing or using materials supply tender and contract documents
  - interpreting materials requirement and purchasing schedule, purchasing budgets, and performance indices for materials supply chain
  - coordinating responses to budget and delivery supply threats related to materials purchases
  - participating in setting and implementing supplier payment policies
  - implementing systems thinking, concurrent engineering, continuous improvement, contingency and constraint management, problem solving and decision making
  - determining implications for materials sourcing of WHS, risk management, codes of practice, and sustainability policy and requirements
  - reporting and documenting results of evaluations, tender analysis, and so on

## Required knowledge

Required knowledge includes:

- planning procedures for materials resourcing in the context of operations, project, strategic and business plans and budgets
- use of systems and software packages to assess materials requirements information, data processing, bill of materials, estimating, supplier database and purchasing budget control
- systems for cost estimation and planning, value engineering, feasibility studies, cost-benefit analysis, life cycle costing and valuation
- supply chain management and value analysis, performance indices or parameters, and monitoring processes
- tender and contract documents, supply agreements, quality and delivery parameters, and terms of payment
- supply chain communications, feedback on quality, supply chain efficiency and continuous improvement processes
- sustainability policy and procedures
- WHS, regulatory and risk management requirements with particular emphasis on handling and use of resources
- WHS and regulatory compliance requirements, material safety data sheets (MSDS), test results, and risk management related to handling and storage
- use of systems thinking, constraints and contingency management, problem solving and decision making, and continuous improvement techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to source and estimate materials for an engineering operation, including interacting with the supply chain. It includes planning and estimating supplies and integrating purchasing into operations. This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• plan for materials resourcing</li> <li>• estimate quantities, source and evaluate materials suppliers</li> <li>• develop tender and contract documents, materials requirement and purchasing schedule, purchasing budgets, and performance indices for materials supply chain</li> <li>• participate, communicate, cooperate, and negotiate with stakeholders on policy and procedures development and implementation</li> <li>• monitor supply of materials against contract requirements and key performance indicators (KPIs)</li> <li>• contribute to organisational management processes, and materials supply chain management.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, or a combination of both on and off the job. The candidate should have access to a workplace where the engineering-related production or project processes and volume of materials used enable the materials sourcing skills covered by this unit to be realistically assessed. Where part of assessment occurs off the job a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>



<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Sustainability implications</b>	<p>Sustainability implications for sourcing and estimating materials in engineering or engineering-related operations may include taking account of:</p> <ul style="list-style-type: none"> <li>• resource consumption</li> <li>• energy consumption and conservation</li> <li>• processing needs</li> <li>• minimisation and processing of waste</li> <li>• transport</li> <li>• distribution</li> <li>• life cycle</li> <li>• reuse, recycle and disposal</li> </ul>
<b>Materials</b>	Materials covered by this unit are those required for the ongoing

	production or performance of an engineering-related project or operation and must meet an engineering specification and for which the delivery must be coordinated with a production or project schedule. The materials will typically be subject to formal supplier agreements or contracts and delivery is to specified cost, times, quality and quantities
<b>Supplier performance</b>	Supplier performance may include: <ul style="list-style-type: none"> <li>• cost</li> <li>• delivery reliability</li> <li>• conformance to quality and quantity specifications</li> <li>• conformance to contract and regulatory requirements</li> <li>• participation in efficiency improvement processes</li> <li>• flexibility</li> </ul>
<b>Software packages</b>	Software packages may include: <ul style="list-style-type: none"> <li>• spreadsheets</li> <li>• databases</li> <li>• word processor</li> <li>• presentation</li> <li>• project management and cost control</li> <li>• system control and data acquisition (SCADA), MRPII and enterprise resource planning (ERP)</li> </ul>
<b>Systems thinking</b>	Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Constraints and contingencies</b>	Contingencies and constraints may include: <ul style="list-style-type: none"> <li>• financial</li> <li>• sudden changes to schedules or delivery by a supplier</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Continuous improvement</b>	Improvement processes may include techniques, such as: <ul style="list-style-type: none"> <li>• balanced scorecard</li> </ul>

<b>implementation</b>	<ul style="list-style-type: none"> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and Codes</b>	Standards and codes refer to all relevant Australian and international standards and applicable codes
<b>MSDS</b>	Organisations using or storing hazardous substances or dangerous goods are required to maintain a MSDS and dangerous goods register. Manufacturers or importers of hazardous substances are obliged to provide an MSDS whenever the substances are first supplied to a customer

## Unit Sector(s)

### Competency field

**Unit sector**            Management and organisation

## Custom Content Section

Not applicable.

# **MEM22017A Coordinate continuous improvement and technical development**

## **Modification History**

Release 1 - New unit. Replaces MEM22008A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to coordinate continuous improvement and ongoing technical development activities for engineering-related operations or projects. It includes feasibility studies, proposals for the introduction of technology or process change and development of implementation strategy, costing and budgets relating to proposals.

## **Application of the Unit**

This unit applies to people with delegated coordination and facilitation responsibilities for implementing engineering-related continuous improvement change and technical development within organisations.

It does not cover design or implementation of major change, such as re-engineering or design and commissioning of new major plant. It is suitable for people working in engineering or related environments in design, maintenance or in operational functions.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential

Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Evaluate project or operations for improvement and technical development opportunities	1.1	Select project or operation for review in conjunction with stakeholders
		1.2	Determine current performance of operations or projects against objectives and key performance indicators (KPIs)
		1.3	Establish and monitor processes to identify shortfalls in performance and root causes
		1.4	Establish and monitor processes to identify possible opportunities for performance and technical improvements
		1.5	Evaluate hardware and software technology requirements for performance improvement opportunities
		1.6	Evaluate personnel skill requirements and training needs for performance improvement opportunities
		1.7	Confirm current or future work health and safety (WHS) requirements, codes of practice, regulations, standards and regulatory requirements related to possible opportunities for performance improvement
2	Develop recommendations for performance improvement and technical development	2.1	Coordinate the specification of options for performance improvement, including required technology changes, skills development needs, timelines, budget and extent of disruption to current operations
		2.2	Coordinate feasibility analyses on options and develop firm proposals
		2.3	Prepare report and recommendations, including objectives, implementation schedule, budget and any required regulatory compliance measures
		2.4	Communicate and negotiate with stakeholders to confirm recommendations for change and technological

## developments

- |   |   |     |   |
|---|---|-----|---|
| 3 | Coordinate implementation of approved changes | 3.1 | Develop implementation objectives, plan, schedule and budgets for approved changes                      |
|   |   | 3.2 | Monitor implementation of objectives by priority, strategy and schedule                                 |
|   |   | 3.3 | Coordinate change management, process redesign and introduction of technology                           |
|   |   | 3.4 | Manage physical and financial resources and budget within delegation                                    |
|   |   | 3.5 | Monitor change and technological development for compliance with organisational policies and procedures |
|   |   | 3.6 | Assist with risk management procedures  |
| 4 | Report outcomes                               | 4.1 | Record progress and results in accordance with procedures   |
|   |   | 4.2 | Provide documentation, data entry and analysis, as required   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying current objectives and performance measures
- identifying change and development opportunities
- evaluating technologies, plant and other assets, hardware and software used by current operations and projects
- identifying skills, knowledge and techniques for operations or projects
- completing feasibility analyses on options and developing of proposals
- maintaining relevant records of plans, priorities, schedules and progress, legislative compliance, personal and team skills development, and sources of technical information and resources

- setting and coordinating priorities, strategy and schedule for changes, including introduction of new technology and continuous improvement operational changes
- problem solving and decision making, systems thinking, constraints and contingency management, short-term planning adjustments, and rescheduling physical and financial resources and budget within delegation
- communicating and negotiating with stakeholders, team members, support function groups, expert technical and professional assistance, customers and suppliers
- monitoring change and technological development for compliance with regulatory requirements
- reporting and documenting progress and results, data and analysis in accordance with procedures

## **Required knowledge**

Required knowledge includes:

- project management techniques
- modern production management techniques
- context of operations, such as competitive pressures or markets, customer-supplier relationships, regulatory and industrial environment, environmental and sustainability, and resourcing and labour issues
- operations or project management structure, functional team relationships, responsibilities and delegations across the organisation, available technical and professional support services, communications and reporting lines
- procedures for audit of technologies, skills, knowledge and techniques, plant and other assets, including hardware and software used by current operations and projects
- feasibility analysis or 'trade-off' methods to assist selection from among options
- accountability and record keeping requirements in accordance with organisational procedures
- tendering and contract requirements and processes and their effect on continuous improvement, including agreement on design and specification, negotiations and optimisations, provisions for variations, delays and penalties
- change and technological development implications for WHS requirements, codes of practice, regulations, standards and regulatory requirements related to proposed changes and technologies
- sustainability issues related to continuous improvement of engineering-related projects and operations
- typical software for program management and budget control, use and validation options
- implementation plan, strategic and prioritised objectives and budgets
- procedures for reporting and recording of progress and records of legislative compliance in accordance with procedures for accountability against objectives, schedule and budget
- requirements for and functions of technical documentation, graphics and specifications and records of meetings, communications and agreements with stakeholders

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to review an existing engineering-related operation or project, including current context and performance objectives, and to identify and implement continuous improvements and technical developments. This includes working individually and in a team environment and recognising and complying with normal control procedures on engineering projects.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• evaluate technologies, assets, workforce and contractor skills and knowledge, personnel development strategies, hardware and software technology requirements, for technology and capability gaps and opportunities for improvement</li> <li>• review organisation structure, current operations and context, development opportunities, budgets and constraints, software options for opportunities for improvement</li> <li>• complete feasibility analyses on options and develop proposals</li> <li>• maintain appropriate documentation and records</li> <li>• demonstrate systems thinking, constraints and contingency management, short-term planning adjustments and rescheduling</li> <li>• manage physical and financial resources and budget within delegation</li> <li>• communicate and negotiate with stakeholders</li> <li>• report and document progress and results, data and analysis in accordance with procedures.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with</li> </ul>



	disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• enterprise or project owners and managers</li> <li>• team members</li> <li>• support function groups</li> <li>• expert technical and professional assistance</li> <li>• customers and suppliers</li> <li>• colleagues identified in reporting arrangements for the engineering project or operation</li> </ul>
<b>Systems thinking</b>	Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to

	perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may include:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Organisational policies and procedures</b>	<p>Organisational policies and procedures may include formal policy documents, operational procedures, mission statements, training manuals, orders, production schedules, safety instructions and notices, and may reference:</p> <ul style="list-style-type: none"> <li>• enterprise agreements and awards</li> <li>• WHS requirements</li> <li>• codes of practice and other legislative requirements</li> <li>• environmental and social obligations</li> <li>• ethical practice</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to the engineering project or operation
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p>

	<ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Lean principles</b>	<p>Lean manufacturing uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness</p>

## Unit Sector(s)

### Competency field

**Unit sector** Management and organisation

## Custom Content Section

Not applicable.

## **MEM22018A Coordinate sales and promotion of engineering-related products or services**

### **Modification History**

Release 1 - New unit. Replaces MEM22009A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to coordinate sales and promotion of engineering-related products or services requiring engineering knowledge. The unit covers ensuring appropriate technical advice is provided to clients, contribution and participation in strategic planning and sales budget setting, control of sales costs against budgets, and responsibility for meeting sales performance indices. It includes a requirement to provide feedback on customer satisfaction and seek out opportunities for improvements.

### **Application of the Unit**

This unit applies to people with coordination responsibilities for sales and promotion of products or services that require engineering knowledge. It is suitable for people working in marketing and sales where detailed engineering-related advice must be provided or where technically advanced products or services are sold.

Prior or concurrently developed competence in personal and electronic communication, self-directed and group activities, planning and scheduling, process improvement, performance analysis, and an understanding of technology, skills and techniques required by operations and projects is required.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Review organisational operations, markets and customer base	1.1	Define sales, service and marketing strategic objectives for engineering-related products or services
		1.2	Establish nature and context of products or services, including market potential, technical advantage, customer-supplier relationships and relevant regulatory requirements
		1.3	Review functional team relationships and organisational fit, available technical and professional support services, communications and reporting lines
		1.4	Review sustainability and life cycle implications of products and services
		1.5	Review legal obligations of organisation and team related to consumer protection, trade practices, environmental and commercial legislation related to product or service delivery
		1.6	Identify relevant organisation accounts and budgets and establish procedures for compliance
		1.7	Identify available software for marketing and sales operations
2	Coordinate sales, service and promotions activities	2.1	Establish implementation plan, schedule and budgets to achieve promotional and sales objectives
		2.2	Establish procedures to record progress against objectives, schedule and budget
		2.3	Participate in and supervise engineering-related sales, service and promotions with stakeholders, including

		customers
	2.4	Establish processes to ensure self and team maintain currency of technical knowledge of organisation's products and services
	2.5	Establish continuous improvement of sales and promotion activities
3	Monitor sales and promotion activities	<div>3.1 Communicate and negotiate with stakeholders to establish organisational capability, feedback on improvement opportunities and customer needs, marketing opportunities, and development needs of sales and marketing team</div> <div>3.2 Address constraints and contingencies, and adjust short-term planning and reschedule, as necessary</div> <div>3.3 Monitor implementation of objectives by priority, strategy and schedule</div>
4	Report outcomes	<div>4.1 Record progress and results in accordance with procedures</div> <div>4.2 Provide documentation, data entry and analysis, as required</div>

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- planning, scheduling and budgeting to achieve promotional, sales and service objectives
- investigating and evaluating options for sales, promotions and marketing team development and training
- identifying technical and market advantage for products or services, regulatory and industrial relations environment
- establishing customer-supplier relationships, current markets and context, marketing and sales opportunities, and constraints

- coordinating implementation of objectives, sales and promotions, personal and team training, continuous improvement, problem solving and decision making
- monitoring marketing team performance
- identifying awards, enterprise agreements personnel entitlements and remuneration arrangements that may impact on technical sales and promotion team activities
- maintaining records
- systems thinking, constraints and contingency management, short-term planning adjustments and rescheduling, marketing team resources and budgeting
- communicating and negotiating with stakeholders
- monitoring products and services for change or change opportunities
- monitoring of team compliance with relevant regulations, including enterprise agreements or awards, WHS, codes of practice, trade practices and consumer law, other legislative requirements, social and economic obligations, and ethical practice
- reporting and documenting progress and results, data and analysis in accordance with procedures

## Required knowledge

Required knowledge includes:

- engineering knowledge relevant to operations and supplied products and services context of marketing and sales, such as competitive pressures or markets, customer-supplier relationships and consumer protection legislation
- organisational management structure, functional team relationships, available technical and professional support services, communications and reporting lines
- audit procedures for personnel current competence, competence gaps and training requirements within marketing team
- opportunities for technological and personnel competence improvement
- sustainability implications of products and services
- organisation mission and business strategy, operations and project plans and objectives
- opportunities and constraints related to sales and promotions
- techniques for analysis of organisational capability, current and future technological needs of customer base, and marketing opportunities
- software options for program management and budget control
- WHS, codes of practice, and other legislative requirements, sustainability and ethical practice related to products and services, marketing team changes and developments
- risk management procedures
- procedures for reporting and recording of progress and records
- legal obligations of organisation and team related to employment conditions, consumer protection, trade practices, environmental and commercial legislation related to procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to coordinate sales of products or services where such sales require engineering-related knowledge and skills, including establishing performance objectives and identifying and implementing continuous improvement.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• define sales and marketing organisational mission and strategic objectives, features and functions within the organisation</li> <li>• plan, schedule and budget to achieve promotional and sales objectives</li> <li>• identify technical and market advantage for products or services, customer-supplier relationships, current markets and context, marketing and sales opportunities, and constraints</li> <li>• investigate and evaluate options for sales, promotions and marketing team development, and complete feasibility analysis on marketing options</li> <li>• maintain records of plans, priorities, schedules and progress, legislative compliance, and personal and team skills development</li> <li>• coordinate implementation of objectives, sales, marketing and promotions, personal and team training, continuous improvement, problem solving and decision making, systems thinking, constraints and contingency management, short-term planning adjustments and rescheduling, and marketing team resources and budget</li> <li>• communicate and negotiate with stakeholders monitor products and services</li> <li>• report and document progress and results, data and analysis in accordance with procedures.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to</li> </ul>



	<p>work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Personal responsibilities</b>	<p>Personal responsibilities may be defined by:</p> <ul style="list-style-type: none"> <li>• role specification</li> <li>• workplace agreement or award</li> <li>• negotiation</li> <li>• contract, legal or regulatory obligations</li> <li>• professional and ethical considerations</li> </ul>
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	<ul style="list-style-type: none"> <li>• agreed operational or project requirements</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Legal obligations</b>	<p>Legal obligations may include:</p> <ul style="list-style-type: none"> <li>• contract law</li> <li>• commercial law</li> <li>• company law</li> <li>• consumer protection Acts and Commonwealth Trade Practices Acts and Regulations</li> <li>• environmental Acts</li> <li>• tax Acts and regulations, including GST and other sales-related provisions</li> <li>• industrial law, including relevant awards and agreements</li> </ul> <p>WHS Act and regulations</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of</p>

	<p>the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to products or services being sold, including:</p> <ul style="list-style-type: none"> <li>• sales operation</li> <li>• product delivery and maintenance</li> <li>• measuring performance against benchmarks</li> <li>• process improvement</li> <li>• problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector** Management and organisation

## Custom Content Section

Not applicable.

## MEM23003A Operate and program computers and/or controllers in engineering situations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating computers and/or controllers in industrial situations and preparing and maintaining programs.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to operating and programming computers &amp;/or controllers in industrial situations. It includes operating computer/controller hardware and software for engineering tasks; developing or customising computer/controller systems or programs.</p> <p>This unit only has application in qualifications that are not points based.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16008A	Interact with computing technology

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Operate a computer and/or controller system	<p>1.1. Operate a range of hardware to complete engineering tasks.</p> <p>1.2. Use appropriate software to produce required outcomes.</p> <p>1.3. Identify and use available sources of help to overcome basic difficulties with applications. Ensure technical instructions are followed and inconsistencies and technical difficulties investigated and resolved. This should include adherence to occupational health and safety regulations / guidelines.</p>
2. Develop/customise computer and/or controller systems/programs	<p>2.1. Work plan for the programming/customising task is prepared in accordance with organizational guidelines.</p> <p>2.2. Programs are written/altered/customised in the required format and computer language. Develop</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>and maintain client engagement with project or task.</p> <p>2.3. Program/system records are maintained and made available to all interested parties following company procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- completing tasks using selected hardware in accordance with manufacturer's instructions and to workplace procedures
- using CPU, I/O, peripherals, interfaces, actuators and other computer/controller equipment
- accessing and using appropriate software in accordance with manufacturer's instructions to complete task requirements
- saving and storing documents and other computer/controller files in an appropriate directory in accordance with manufacturer's instructions and workplace procedures
- identifying and analysing difficulties using appropriate help sources
- preparing work plans for programming/customising task
- writing/altering/customising programs
- testing and amending programs
- maintaining records

#### Required knowledge

Look for evidence that confirms knowledge of:

- functions and operating procedures of CPU, I/O, peripherals, interfaces, actuators and other computer/controller equipment
- applications of available hardware and criteria for selecting the hardware for particular tasks
- procedures for operating hardware
- procedures for checking and replacing hardware consumables
- available software and their applications

## REQUIRED SKILLS AND KNOWLEDGE

- procedures and commands for the use of identified software
- procedures and related requirements for saving and storing documents and computer/controller files
- techniques for accessing, transferring, printing documents or other computer files or using computer files to control plant and equipment
- techniques for accessing and using manuals and training booklets to solve minor problems
- procedures for accessing sources of help
- techniques for accessing help with typical difficulties with selected applications
- typical programming/customising sequencing and related issues
- techniques and procedures for preparing a work plan for a programming/customising task
- techniques and procedures for writing/customising programs in specified formats and computer language
- techniques and procedures for testing and amending programs
- procedures for checking program alteration with users
- procedures for maintaining records and reports on program/system development or enhancement
- procedures for disseminating information on program/system development

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to operate and program computers and/or controllers in engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for

This unit may be assessed on the job, off the job or a

<b>EVIDENCE GUIDE</b>	
<b>assessment</b>	<p>combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating and programming computers and/or controllers in engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying calculus in engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Hardware</b>	<p>Personal computers, networked systems, personal organisers, communications equipment, PLC and microprocessor controllers, computer controlled machinery and systems, etc.</p>



<b>RANGE STATEMENT</b>	
<b>Tasks</b>	To be carried out under appropriate supervision using predetermined standards of safety, computer application and technical analysis
<b>Software</b>	Commercial software applications, CAD and CAM software, organisation specific software, PLC or microprocessor controller software, word processing, spreadsheet, database, graphic, communication packages and presentation packages, etc
<b>Technical instructions</b>	Manufacturer's and organisational instructions for use of specific computer hardware
<b>Inconsistencies and technical difficulties</b>	Resolved in consultation with appropriate technical advisers
<b>Occupational health and safety regulations / guidelines</b>	Screen based equipment, computing equipment and peripherals and ergonomic work stations, etc.
<b>Programming</b>	Visual Basic, Ladder Logic, Flow Chart, program customising, spreadsheet programming, writing macros, setting up/varying databases and the like.
<b>Organisational guidelines</b>	Security procedures, OH&S procedures, maintenance procedures, etc.
<b>Develop and maintain client engagement</b>	Ongoing communication with clients required to ensure that engineering services are effectively delivered

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	
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<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering science
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## **MEM23004A Apply technical mathematics**

### **Modification History**

Release 1 - New unit. Replaces MEM23001A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the application of mathematical analysis, graphical and software techniques to engineering problems. It includes exponential and logarithmic functions, trigonometric equations involving single and double angles, sequences and series, two dimensional vector analysis, complex numbers, determinants and matrices.

### **Application of the Unit**

The unit applies to engineering or related activities requiring specific mathematical techniques. It is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of technical mathematical techniques required for an engineering application	1.1	Analyse an engineering application for required technical mathematical tasks
		1.2	Develop systematic methods for layout and solution checking
		1.3	Determine mathematical software required for analytical and graphical solutions and validate software using traditional solutions to simple examples
2	Apply technical mathematical techniques to engineering application	2.1	Use appropriate software for analytical and graphical solutions
		2.2	Convert between different number systems
		2.3	Use appropriate mathematical techniques required for analysis and solution
		2.4	Use appropriate data representations to communicate the solution to others.
		2.5	Report results and document calculations, graphs and analysis

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- solving mathematical problems using standard engineering software packages, and validating software results of simple examples analytically and/or graphically
- manipulating values using decimal, binary and hexadecimal number systems
- graphing and analysing functions for solutions:
  - exponential and logarithmic functions
  - trigonometric functions
- using the techniques of sequences and series to solve simple mathematical problems
- using the techniques of two dimensional vectors to solve mathematic and applied problems
- solving problems involving complex quantities using the properties, operations and theorems

of complex numbers

- using determinant and matrix analysis to solve algebraic and vectorial problems
- using probability to assess likely occurrences

## Required knowledge

Required knowledge includes:

- software for mathematical analysis and graphical representations
- binomials and polynomials
- exponential and logarithmic functions
- trigonometric equations
- sequences and series
- two dimensional vectors
- complex numbers
- determinant and matrices
- probability
- stability analysis using plots

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply mathematical analysis, graphical and software techniques to engineering-related problems within the context of delegations and other checking and technical oversight procedures. The candidate may demonstrate competence through either working individually or as part of a team.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• solve mathematical problems using software</li> <li>• validate software results of simple examples analytically and/or graphically</li> <li>• manipulate values using decimal, binary and hexadecimal number systems</li> <li>• graph and analyse exponential, logarithmic and trigonometric functions for solutions</li> <li>• use the techniques of sequences and series to solve simple</li> </ul>

	<p>mathematical problems</p> <ul style="list-style-type: none"> <li>• use the techniques of two dimensional vectors to solve mathematic and applied problems</li> <li>• solve problems involving complex quantities using the properties, operations and theorems of complex numbers</li> <li>• use determinant and matrix analysis to solve algebraic and vectorial problems</li> <li>• use probability to assess likely occurrences.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering applications related to mathematical techniques in this unit</b>	<p>Most engineering disciplines will have applications supported by the technical mathematics skills described in this unit, including mechanical, manufacturing, maintenance and mechatronics engineering. Examples of engineering applications requiring mathematical skills described in this unit may include:</p> <ul style="list-style-type: none"> <li>• vector analysis of force systems on beams and bodies</li> <li>• trigonometric plots related to waveforms for amplitude, frequency and phase shift analysis</li> <li>• matrix and determinant solutions of vector systems or simultaneous equations</li> <li>• complex plane analysis of control systems for stability analysis</li> </ul>
<b>Scope of technical mathematical techniques</b>	<p>The scope of technical mathematical techniques required for an engineering application will vary and may include:</p> <ul style="list-style-type: none"> <li>• standard mathematical software</li> <li>• decimal, binary and hexadecimal number systems</li> <li>• graph exponential and logarithmic functions required for the engineering application</li> <li>• solve trigonometric equations involving single and double angles</li> <li>• solve problems using simple binomials and polynomials</li> <li>• solve problems involving simple sequences and series in the engineering application</li> <li>• analyse two dimensional vectors</li> <li>• analyse complex numbers and represent graphically</li> <li>• analyse simple algebraic and vectorial problems using determinants and matrices</li> <li>• evaluate probability as a predictive tool in simple situations</li> </ul>
<b>Number system</b>	<p>Number systems may include:</p> <ul style="list-style-type: none"> <li>• decimal</li> <li>• binary</li> <li>• hexadecimal</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.



# **MEM23005A Apply statistics and probability techniques to engineering tasks**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the application of statistics and probability techniques to engineering applications. It includes the use and application of standard statistical and probability concepts and modelling methods, such as mean, median, mode, frequency distribution, standard deviation plus probability laws, distributions, permutations and combinations to engineering and manufacturing situations.

## **Application of the Unit**

The unit applies to engineering or related activities requiring the application of statistical and probability techniques. It is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of statistics or probability techniques required for an engineering application	1.1	Analyse an engineering application for required statistics or probability tasks
		1.2	Develop systematic methods for layout and solution validation, including any required external sign-off of solution
		1.3	Identify statistics or probability techniques and any software required for analysis and resolution of identified engineering tasks
		1.4	Identify sources for professional and technical assistance, if required
2	Apply statistical techniques to engineering applications	2.1	Apply standard statistics concepts and models to solve engineering problems
		2.2	Check statistical model and solution is error free
		2.3	Review model and solution to ensure they provide information relevant to resolution of engineering application task
		2.4	Report results and document calculations, graphs and analysis
3	Apply probability techniques to engineering applications	3.1	Apply standard probability concepts and models to solve engineering problems
		3.2	Check model and solution is laid out correctly and is error free
		3.3	Review solution to ensure it provides information relevant to resolution of engineering application task
		3.4	Report results and document calculations, graphs and analysis

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing engineering applications to determine relevant statistics and probability techniques
- applying relevant statistical and probability concepts and tools and applying to engineering applications
- using appropriate software to generate solutions to statistical and probability-related engineering problems
- establishing appropriate procedures for checking and validating solutions
- logical layout and presentation of data
- reporting and effectively communicating the results of statistical and probability-based analysis

### Required knowledge

Required knowledge includes:

- meaning and appropriate application of discrete and continuous data
- concepts of mean, median and mode and their application to engineering and manufacturing problems requiring statistics-based solutions
- standard deviation, range, interquartile range and frequency distributions
- use of appropriate software and/or scientific calculators to generate solutions to statistical and probability-related engineering problems and methods for presentation of data, such as:
  - frequency distribution tables
  - histograms
- the concept of variance and its application to engineering and manufacturing situations
- application of statistical modelling to engineering and manufacturing situations
- translation of statistical data into engineering parameters and the applications to:
  - process improvement techniques
  - reliability analysis
- concepts of probability:
  - single events
  - multiple events
  - with permutations and combinations
- probability distributions:
  - normal
  - binomial
- sampling distributions:
  - sample size

- statistical significance
- confidence intervals
- application of probability-based solutions to engineering and manufacturing problems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply statistics and probability techniques to engineering-related problems within the context of specified engineering applications and other solution validation and technical oversight procedures. The candidate may demonstrate competence through either working individually or as part of a team.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• solve engineering and manufacturing problems using statistics and probability techniques</li> <li>• validate results of simple examples using statistics and probability either analytically and/or graphically</li> <li>• assist decision making processes in industry by analysis of data using statistical and probability concepts and tools.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering applications related to statistics and probability techniques in this unit</b>	<p>Most engineering disciplines will have applications supported by the statistics and probability skills described in this unit, including mechanical, manufacturing, maintenance and mechatronics engineering. Examples of engineering applications requiring statistics and probability skills described in this unit may include:</p> <ul style="list-style-type: none"> <li>assisting decision making in industry by analysis of data using statistical and probability concepts and tools</li> <li>informing maintenance decisions and reliability analysis</li> <li>identifying the most appropriate outcome of manufacturing trials</li> <li>determining the effectiveness of process improvement techniques</li> </ul>
<b>Scope of statistical and probability techniques</b>	<p>The scope of statistics and probability techniques required for an engineering or manufacturing application will vary and may include:</p> <ul style="list-style-type: none"> <li>use of discrete or continuous data</li> <li>application of measures of central tendency, such as: <ul style="list-style-type: none"> <li>mean</li> <li>median</li> <li>mode</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• application of measures of distribution, such as:<ul style="list-style-type: none"><li>• standard deviation</li><li>• range</li><li>• interquartile range</li></ul></li><li>• analysis of statistical inference, such as:<ul style="list-style-type: none"><li>• sample size</li><li>• statistical significance</li></ul></li><li>• application of probability concepts and tools, such as:<ul style="list-style-type: none"><li>• probability laws</li><li>• probability distributions</li></ul></li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23006A Apply fluid and thermodynamics principles in engineering**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the application of fluid and thermodynamic principles to engineering applications. It includes sustainability issues; fundamental scientific principles; fundamentals of vacuum technology; properties of gases and liquids; heat transfer due to conduction, convection and radiation heat and compression processes; closed and open systems; continuity, enthalpy and energy transfers related to compressors, boilers, turbine heat exchangers, heat engines, refrigerators and heat pump performance. It also includes fluid systems and components, forces on floating and submerged bodies, turbine and pumping systems, and jet forces on blades and plates.

## **Application of the Unit**

This unit applies to fluid and thermodynamic devices and systems used in industry. It is suitable for people working as technicians in engineering or related fields using hydrostatic, hydrodynamic, fluid power or heating, ventilation and air conditioning (HVAC) equipment and those pursuing careers and qualifications in engineering or related disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Determine scope of fluid or thermodynamic application                    | 1.1 Determine compliance requirements of work health and safety (WHS) and regulatory requirements, codes of practice standards, risk assessment and registration requirements<br><br>1.2 Review sustainability implications of fluid and thermodynamic tasks<br><br>1.3 Assess fluid, thermodynamic and vacuum principles, skills and techniques required by tasks<br><br>1.4 Review functions and features of fluid, thermodynamic and vacuum devices, machines and systems<br><br>1.5 Assess software techniques required for analysis and graphics required by the task  |
| 2 | Interpret fluid or thermodynamic system design for effective performance | 2.1 Determine the energy cost for running boilers, heat engines, compressors or turbines over a billing period, the efficiency of conversion of energy source to electrical, fluid, thermal or mechanical power and the sustainability of the processes<br><br>2.2 Select components for thermal and fluid systems ensuring compatible materials, pressure, temperature and flow capacity and appropriate performance<br><br>2.3 Determine pumping system power requirements to provide for raising fluid, adequate flow rate and specified system losses<br><br>2.4 Specify vacuum system components and performance requirements for moulding, dust removal, film deposition, chemical reaction control, and prove or test performance of specified system or individual components |



- |   |                |  |
|---|----------------|--|
|   | 2.5            | Seek technical and professional assistance or clarification of design information, as required           |
|   | 2.6            | Ensure clear and logical process of specification development and compatibility of units in calculations |
| 3 | Report results | 3.1 Record results of investigation, evaluation and application  |
|   |                | 3.2 Provide documentation, such as calculations, diagrams, programs and files                            |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining and confirming parameters and context of tasks, personal responsibilities, team and support personnel relations, chain of responsibility, WHS, regulatory requirements, risk management and organisational procedures
- reviewing sustainability implications, functions and features of fluid, thermodynamic and vacuum devices, machines and systems
- assessing and applying fluid, thermodynamic and vacuum principles and software skills and techniques
- ensuring clear and logical process of specification development and compatibility of units in calculations
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

### Required knowledge

Required knowledge includes:

- definition of fluid mechanics and thermodynamics and recognition of applications
- analytical, graphical, semi-graphical and software assisted techniques for applications for fluid and thermodynamic principles in engineering
- energy and sustainability concepts relevant to fluid and thermodynamic applications
- principles of turbines and heat engines
- basic properties and concepts common to fluids and thermodynamics:

- atoms, molecules, inter-molecular forces, molecular motion, states of matter, solids, liquids, gases, basic properties and units
- ideal or perfect gases and liquids
- definitions
- energy types and concepts:
  - potential energy, kinetic energy and internal energy
  - chemical energy = energy content of a fuel
  - work, constant and variable force, relationship to pressure and volume changes
  - sensible heat and specific heat capacity ( $C_p$  and  $C_v$ )
  - phase change, latent heat, enthalpy and enthalpy diagram
- heat transfer processes
- concepts and properties of gases
- energy transfer in closed and open systems:
  - definition of a closed system
  - non-flow energy equation definition of an open system
  - mass and volume flow rate and the continuity equation
- fluid mechanics
- fluid system components
- fluid statics
- fluid dynamics
- fluid power
- vacuum technology:
  - definition of vacuum
  - states of matter
  - purposes of vacuums
  - degrees of vacuum
- methods of lowering pressure:
  - displacement or transfer of gas
  - sorption or condensation
- barometric pressure:
  - inverted mercury tube
  - variation of atmospheric pressure with altitude
- quantity of gas:
  - mole, Avogadro's Number and molar mass
- types of vacuum pumps for evacuating volumes
- description of typical vacuum vessels, features and functions
- applications of vacuum technology in industry

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply fluid, thermodynamic and vacuum principles to the selection and evaluation of components and systems.</p> <p>This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• review sustainability implications, functions and features of fluid, thermodynamic and vacuum devices, machines and systems</li><li>• interpret fluid, thermodynamic and vacuum system designs for industry applications</li><li>• select components for specified technical performance</li><li>• calculate energy use in fluid, thermodynamic and vacuum system</li><li>• assess and apply fluid, thermodynamic and vacuum principles and software skills and techniques to engineering tasks.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li><li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering</li></ul>

	<p>Training Package.</p> <ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Fluid and thermodynamic tasks</b>	<p>Fluid and thermodynamic tasks covered by this unit may include:</p> <ul style="list-style-type: none"> <li>• energy costs, efficiency and sustainability assessment of running boilers, heat engines, compressors or turbines</li> <li>• fluid and thermal system component selection</li> <li>• pumping and turbine system power evaluation</li> <li>• evaluating vacuum system components and performance requirements</li> </ul>
<b>Basic properties and units common to fluids and thermodynamics</b>	<p>Basic properties and units include:</p> <ul style="list-style-type: none"> <li>• mass, weight and force</li> <li>• volume, density, specific volume and relative density</li> <li>• pressure (absolute and gauge), and atmospheric pressure</li> </ul>

	<p>variation</p> <ul style="list-style-type: none"> <li>• temperature (Celsius, Kelvin and others)</li> <li>• viscosity and surface tension</li> <li>• vapour pressure of a liquid (saturation vapour pressure)</li> <li>• temperature and pressure effects on properties</li> <li>• international system of units (SI)</li> <li>• fundamental dimensions and units</li> <li>• derived dimensions and units</li> </ul>
<b>Static and hydrodynamic devices or systems</b>	<p>Static and hydrodynamic devices or systems may include:</p> <ul style="list-style-type: none"> <li>• floating and submerged bodies</li> <li>• turbine and pumping systems</li> <li>• stationary or moving plates or blades</li> <li>• vacuum systems</li> </ul>
<b>Thermodynamic devices or systems</b>	<p>Thermodynamic devices or systems may include:</p> <ul style="list-style-type: none"> <li>• heat transfer devices</li> <li>• compressors</li> <li>• boilers</li> <li>• turbines</li> <li>• heat exchangers</li> <li>• heat engines</li> <li>• refrigerators</li> <li>• heat pumps</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p>

	<ul style="list-style-type: none"><li>• WHS Acts and regulations</li><li>• relevant standards</li><li>• codes of practice</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• state and territory regulatory requirements</li></ul>
<b>Enthalpy</b>	Enthalpy is a thermodynamic property equal to the sum of the internal energy of a system and the product of its pressure and volume

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

## **MEM23007A Apply calculus to engineering tasks**

### **Modification History**

Release 1 - New unit. Replaces MEM23002A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the application of calculus, including differentiation and integration techniques to engineering applications. It includes the use and application of standard differentiation and integration rules, finding maximum and minimum values of curves, application to rates of change and slope, finding definite integrals, using method of substitution, using trigonometric identities and finding areas under curves.

### **Application of the Unit**

The unit applies to engineering or related activities requiring the application of mathematical techniques using calculus. It is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23004A                      Apply technical mathematics

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of calculus techniques required for an engineering application	1.1	Analyse an engineering application for required calculus tasks
		1.2	Develop systematic methods for layout and solution validation, including any required external sign-off of solution
		1.3	Identify calculus technique and any software required for analysis and resolution of identified engineering application tasks
		1.4	Identify sources for professional and technical assistance, if required
2	Apply differential techniques to engineering applications	2.1	Apply standard differentiation rules to solve engineering problems
		2.2	Check solution is laid out correctly and is error free
		2.3	Review solution to ensure it provides information relevant to resolution of engineering application task
		2.4	Report results and document calculations, graphs and analysis
3	Apply integration techniques to engineering applications	3.1	Apply standard integration rules to solve engineering problems
		3.2	Check solution is laid out correctly and is error free
		3.3	Review solution to ensure it provides information relevant to resolution of engineering application task
		3.4	Report results and document calculations, graphs and analysis



## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing engineering applications to determine relevant calculus techniques
- applying relevant differentiation and integration concepts and tools to engineering applications
- using appropriate software and/or scientific calculators to generate solutions to statistical and probability-related engineering problems
- using differentiation to find rates of change
- applying special calculus techniques to solve more complex integrals, such as:
  - method of substitution
  - using trigonometric identities
- identifying and solving simple first and second order differential equations
- identifying key points to find constants of integration
- finding integrals of algebraic, trigonometric and exponential functions
- establishing appropriate procedures for checking and validating solutions
- logical layout and presentation of data developed using calculus
- reporting and effectively communicating the results of calculus-based analysis

### Required knowledge

Required knowledge includes:

- identifying appropriate limits and applying to engineering problems being solved with calculus techniques
- differentiation rules and techniques
- partial differentiation
- relationship between differentiation and attributes of mathematical curves and graphs
- optimisation of variables based on maximum and minimum values of mathematical curves and graphs
- integration as the reverse of differentiation
- integration rules and techniques
- the definite integral

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply calculus techniques to engineering and related problems within the context of specified engineering applications and solution validation and technical oversight procedures. The candidate may demonstrate competence through either working individually or as part of a team.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• solve mathematical problems related to engineering and manufacturing using calculus techniques</li> <li>• validate results of mathematical problems using calculus either analytically and/or graphically</li> <li>• manipulate engineering and manufacturing-related mathematical functions and equations using calculus techniques</li> <li>• analyse mathematical problems by using appropriate calculus techniques to achieve engineering and manufacturing solutions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units</li> </ul>

	of competency where required.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering applications related to calculus techniques in this unit</b>	<p>Most engineering disciplines will have applications supported by the calculus skills described in this unit, including mechanical, manufacturing, maintenance and mechatronics engineering. Examples of engineering or manufacturing applications requiring calculus skills described in this unit may include:</p> <ul style="list-style-type: none"> <li>• determining the point of maximum bending moment, slope and deflection for a beam</li> <li>• determining the depth of parabolic mirrors</li> <li>• determining moments of inertia of a range of engineering components</li> <li>• solving rectilinear motion problems</li> </ul>
<b>Scope of calculus techniques</b>	<p>The scope of calculus techniques required for an engineering or manufacturing application will vary and may include:</p> <ul style="list-style-type: none"> <li>• identification of appropriate limits</li> <li>• use of standard derivatives and rules</li> <li>• application of second and third derivatives</li> <li>• finding rates of change and slopes of curves</li> <li>• calculating maximum and minimum values of curves</li> <li>• solving first and second order differential equations</li> <li>• use of standard integrals and rules</li> <li>• finding constants of integration</li> <li>• finding areas under and between curves</li> <li>• integrating algebraic, trigonometric and exponential functions</li> <li>• the definite integral</li> <li>• identification of appropriate methods to solve more complex integration applications</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

# **MEM23008A Apply advanced algebra and numerical methods to engineering tasks**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the application of advanced mathematics and numerical methods techniques to engineering situations. It includes the use and application of advanced mathematics and numerical methods, concepts and modelling methods, such as vectors in 3-D with i, j, k notation; analytical geometry; graphing techniques; complex numbers; linear algebra, including solving matrices, numerical solutions, errors and propagation of errors; plus interpolation and extrapolation.

## **Application of the Unit**

The unit applies to engineering or related activities requiring the specific application of advanced mathematics or numerical methods techniques. It is suitable for people giving technical support to design, operations or maintenance activities and those pursuing technical qualifications and careers at paraprofessional or technician level.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of advanced mathematics and numerical methods required for an engineering application	1.1	Analyse an engineering application for required advanced mathematics or numerical methods tasks
		1.2	Develop systematic methods for layout and solution validation, including any required sign-off of solution
		1.3	Identify advanced mathematics or numerical methods and any software required for analysis and resolution of identified engineering application tasks
2	Apply advanced mathematics techniques to engineering applications	2.1	Apply advanced mathematics concepts and models to solve engineering or manufacturing problems
		2.2	Check answer by appropriate means
		2.3	Interpret answer to determine information required by problem definition
		2.4	Report results and document calculations, graphs and analysis
3	Apply numerical methods to engineering applications	3.1	Apply numerical methods concepts and models to solve engineering problems
		3.2	Check solution is laid out correctly and is error free
		3.3	Review solution to ensure it provides information relevant to resolution of engineering application task
		3.4	Report results and document calculations, graphs and analysis

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing engineering applications to determine relevant algebra and numerical methods
- applying relevant advanced mathematics and numerical methods concepts and tools to engineering situations
- using appropriate software and/or scientific calculators to generate solutions to algebra and numerical methods problems
- establishing appropriate procedures for checking and validating solutions
- logical layout and presentation of data developed using algebra and numerical methods
- reporting and effectively communicating the results of advanced mathematics and numerical methods-based analysis

### Required knowledge

Required knowledge includes:

- vectors:
  - vectors in 3-D
  - $i$ ,  $j$  and  $k$  notation
  - magnitude of a vector
  - unit vectors and direction angles
  - scalar or 'dot' product of two vectors
  - vector or 'cross' product of two vectors
  - resolution of vectors
  - differentiation and integration of vectors
- dynamics:
  - Newton's Laws of Motion
  - energy, work and power
  - work-energy theorem
  - moment of a force
- analytical geometry:
  - equation of a plane
  - angle between two planes
  - distance from a point to a plane
  - lines in 3-D space
- graphing techniques:
  - coordinate geometry

- graphs of exponential growth and decay
- graphs with logarithmic scales
- method of least squares
- polar coordinates and polar graphs
- graphs of functions of two variables
- quadric surfaces
- complex numbers:
  - introduction to complex numbers
  - cartesian form
  - the Argand plane
  - trigonometric and polar form
- linear algebra:
  - matrix algebra
  - transformations
  - determinants
- numerical solutions:
  - finite difference techniques
- errors:
  - computer arithmetic
  - propagation of errors
- interpolation and approximation:
  - polynomial interpolation
  - Lagrange form
  - Newton's divide formula
  - error bound

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply advanced mathematics and numerical methods techniques to engineering-related problems within the context of specified engineering applications and solution validation and technical oversight procedures. The candidate may demonstrate competence through either working individually or as part of a team.
<b>Critical aspects for</b>	Assessors must be satisfied that the candidate can competently and



<b>assessment and evidence required to demonstrate competency in this unit</b>	<p>consistently:</p> <ul style="list-style-type: none"> <li>• solve engineering problems using advanced mathematics and numerical methods techniques</li> <li>• validate results of simple examples using advanced mathematics and numerical methods either analytically and/or graphically using appropriate software or scientific calculators</li> <li>• assist decision making processes in industry by analysis of data using advanced mathematics and numerical methods concepts and tools.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering applications related to advanced mathematics and numerical methods techniques in this unit</b>	<p>Most engineering disciplines will have applications supported by the advanced mathematics and numerical methods skills described in this unit, including mechanical, manufacturing, maintenance and mechatronics engineering. Examples of engineering applications requiring advanced mathematics and numerical methods skills described in this unit may include:</p> <ul style="list-style-type: none"> <li>• assisting decision making in industry by analysis of data using advanced mathematics and numerical methods concepts and tools</li> <li>• assisting presentation of data in industry by use of advanced graphical techniques</li> <li>• solution of problems involving rectilinear and rotation motion</li> <li>• solution of problems involving work, energy and power</li> <li>• solution of problems in electrostatics and wave propagation</li> </ul>
<b>Scope of advanced mathematics and numerical methods techniques</b>	<p>The scope of advanced mathematics and numerical methods techniques required for an engineering or manufacturing application will vary and may include:</p> <ul style="list-style-type: none"> <li>• vectors in 3-D, including <math>i, j, k</math> notation, scalar and vector products</li> <li>• dynamics, including Newton's Laws of Motion, energy, work and power and work-energy theorem</li> <li>• analytical geometry</li> <li>• graphing techniques, including coordinate geometry, polar coordinates and polar graphs</li> <li>• complex numbers, including Cartesian, trigonometric and polar form</li> <li>• linear algebra, including matrix algebra</li> <li>• numerical solutions, including finite difference techniques</li> <li>• errors and propagation of errors</li> <li>• interpolation and approximation</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

## **MEM23052A Apply basic electro and control scientific principles and techniques in aeronautical engineering**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers applying basic electro and control scientific principles and techniques to aeronautical engineering situations.

### **Application of the Unit**

Applications of this unit include applying basic electro and control scientific principles and techniques as a member of a design and development team in support of the design and development of engineering applications; identifying a significant range of basic electro and control scientific principles and techniques relevant to aeronautical engineering; selecting electro and control principles and techniques for particular aeronautical applications; and applying electro and control principles and techniques appropriately to aeronautical engineering tasks.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable

### **Employability Skills Information**

This unit contains employability skills

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |  |  |
|--|--|
| 1 Research and identify the range of basic electro and control scientific principles and techniques relevant to aeronautical engineering | 1.1 Research and report on basic electro and control scientific principles relating to aeronautical engineering from appropriate sources of information and examination of applications          |
|  | 1.2 Identify basic electro and control techniques and associated technologies, software and hardware required to implement scientific principles relating to aeronautical engineering situations |
| 2 Select basic electro and control scientific principles and techniques relevant to particular aeronautical engineering applications     | 2.1 Select the relevant basic electro and control scientific principles for particular aeronautical engineering situations   |
|  | 2.2 Select the relevant basic electro and control techniques and associated technologies, software and hardware for particular aeronautical engineering situations                               |
| 3 Apply the relevant basic electro and control scientific principles and techniques appropriately  | 3.1 Apply basic electro and control scientific principles in a consistent and appropriate manner to obtain any required solution   |
|  | 3.2 Use appropriate calculations and coherent units in the solution of engineering calculations  |
|  | 3.3 Use significant figures in engineering calculations  |
|  | 3.4 Apply basic electro and control techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions                            |
| 4 Quote the results of the application of the basic electro and control scientific principles and techniques correctly                   | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style  |
|  | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style  |

## Required Skills and Knowledge

Required knowledge includes:
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- electro and control scientific principles
- limitations of selected basic scientific principles
- basic electro and control techniques and related technologies, software and hardware associated with implementing scientific principles in aeronautical engineering solutions
- limitations of basic techniques and associated technologies, software and hardware
- applicability and limitations of basic electro and control scientific principles
- applicability and limitations of basic electro and control and associated technologies, software and hardware
- appropriateness of calculations
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for carrying out dimensional analysis
- the concept of significant figures
- uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities

Required skills include:

- selecting appropriate basic electro and control scientific principles to suit specified applications
- selecting appropriate basic electro and control techniques and associated technologies, software and hardware to suit specified applications
- applying basic electro and control scientific principles to particular aeronautical engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations
- checking the validity of equations using dimensional analysis
- applying basic electro and control techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application
- quoting solutions in appropriate units, using appropriate significant figures
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply basic electro and control scientific principles and techniques in aeronautical engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic electro and control scientific principles and techniques in mechanical and manufacturing engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

<b>Aeronautical engineering</b>	<p>Aeronautical engineering refers to:</p> <ul style="list-style-type: none"><li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li></ul>
<b>Sources of information</b>	<p>Sources of information may include:</p> <ul style="list-style-type: none"><li>reference texts</li><li>manufacturer catalogues and industrial magazines</li><li>websites</li><li>use of phone, email and fax information gathering</li></ul>
<b>Basic scientific techniques and principles</b>	<p>Basic scientific techniques and principles refers to calculations and the use of coherent units in the completion of tasks, and may include:</p> <ul style="list-style-type: none"><li>basic hand and power tool operations</li><li>machining</li><li>fitting</li><li>welding</li><li>moulding</li><li>fabricating</li><li>wiring</li><li>programming</li></ul>
<b>Aeronautical engineering situations</b>	<p>Aeronautical engineering situations may include:</p> <ul style="list-style-type: none"><li>electro-hydraulic and electro-pneumatic systems</li><li>fuel storage and distribution systems</li><li>engine control systems</li><li>propeller control systems</li><li>flight control systems</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.



# **MEM23063A Select and test mechanical engineering materials**

## **Modification History**

Release 1 - New unit. Replaces MEM23061A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills needed to interpret design information for material and material test requirements, select appropriate tests and use results in the selection of appropriate materials for mechanical and manufacturing engineering-related applications.

## **Application of the Unit**

This unit applies to the selection of materials and material tests, sourcing materials data, ensuring appropriate performance and physical standards for mechanical and manufacturing applications, documenting materials tests, and ensuring calibration standards. The unit applies to mechanical and manufacturing engineering applications in mass production, batch production, jobbing shop and prototyping.

Activities may be performed as a member of a design and development team.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Distinguish classes of materials, based on properties and materials tests, relevant to mechanical and manufacturing engineering	1.1	Relate material properties to common mechanical and manufacturing engineering methods and processes
		1.2	Identify common characteristics, faults or flaws in materials, components and product
		1.3	Identify engineering-related test methods for materials and components or product properties
		1.4	Identify common industrial test standards/codes, calibration requirements, regulations and authorities relevant to selection of materials and products for mechanical and manufacturing engineering applications
2	Utilise sources of information on engineering materials, materials tests and test equipment	2.1	Review design information for material specifications and required material tests
		2.2	Identify and use appropriate sources of information on materials, material tests and test calibration
		2.3	Identify and use appropriate sources of information on methods of testing of properties of materials
		2.4	Investigate and report on relevant standards and codes
		2.5	Identify and use appropriate sources of information on materials safety data sheets (MSDS)
		2.6	Establish availability of technical and professional assistance
3	Test for or obtain the properties of engineering	3.1	Specify required materials tests and manage implementation of tests to ensure quality, safety and suitability for applications

materials	3.2	Ensure traceability of measurement standard
	3.3	Obtain test sheets/certificates for appropriate materials for applications in accordance with organisational procedures and/or codes and regulations
	3.4	Obtain appropriate MSDS for applications in accordance with organisational procedures and/or codes and regulations
4	4.1	Select materials for use in given mechanical or manufacturing engineering applications based on relevant test information
	4.2	Incorporate materials and components into mechanical and manufacturing processes in accordance with design functional requirements
5	5.1	Report and record materials selections against design functional requirements in accordance with organisational procedures, codes and regulations
	5.2	Undertake any required environmental impact and sustainability assessment
	5.3	Report and record materials tests and test sheets or certificates in accordance with organisational procedures, codes and regulations, including appropriate calibration and traceability
	5.4	Report and record appropriate MSDS for applications in accordance with organisational procedures, codes and regulations

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting class of materials for an application based on comparison of properties for a significant range of materials classes
- selecting class of materials for an application suitable to mechanical and manufacturing engineering-related methods and processes
- identifying common characteristics, faults or flaws in materials
- identifying test methods for properties of, and faults and flaws in, materials and components
- identifying industrial test standards and regulations for materials and particular engineering applications
- selecting the most appropriate tests and test methods from a range of possible tests
- identifying and applying standards and regulations for materials and components
- sourcing and using materials test sheets and certificates
- sourcing and implementing MSDS
- implementing tests correctly for materials and component properties and faults
- interpreting design documentation for materials and materials testing requirements
- applying environmental and sustainability requirements to material selection
- reporting, recording and filing test reports and documentation
- implementing materials tests and test sheets/certificates, test calibration and traceability

## Required knowledge

Required knowledge includes:

- properties of materials classes
- the effect of material properties, faults or flaws on mechanical and manufacturing engineering methods and processes
- test methods and procedures for materials and components, including specific industrial test standards, regulations and authorities related to particular engineering applications
- test methods for faults or flaws in materials and components or product
- sources and uses of information on materials and materials tests, including test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing MSDS
- significance of test sheets/certificates to applications
- significance of MSDS and relevance of procedures
- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test procedures, reports and documentation to applications, including the need for obtaining and filing test sheets and certificates
- significance of test calibration and traceability

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select and test mechanical engineering materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• review design information for materials and materials test requirements</li> <li>• select classes of materials relevant to design for further research, testing and evaluation</li> <li>• identify standards, codes and regulatory requirements relevant to materials testing and application</li> <li>• specify appropriate tests and interpret test results for material selection</li> <li>• select materials consistent with test results and design and regulatory requirements</li> <li>• ensure traceability in material selection process</li> <li>• correctly document all results and tests.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> <li>• This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing mechanical engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning</li> </ul>

	<p>knowledge to ensure correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Classes of materials</b>	<p>Classes of materials include:</p> <ul style="list-style-type: none"> <li>• non-ferrous metals and alloys</li> <li>• ferrous metals</li> <li>• non-metals (e.g. timber, concrete, ceramics, polymers and fabrics, adhesives and lubricants)</li> <li>• thermal and electrical conductors and insulators</li> </ul>
<b>Properties and characteristics of materials</b>	<p>Properties and characteristics of materials may include:</p> <ul style="list-style-type: none"> <li>• physical properties (e.g. strength; elasticity; plasticity; malleability; hardness; toughness; brittleness; fatigue endurance; mouldability; weldability; machinability; formability; resistance to creep and stress relaxation; resistance to degradation, such as use of plastic fillers to enhance UV resistance; adhesion; electrical, magnetic, thermal, chemical and optical; material structure and effect on properties)</li> <li>• susceptibility to corrosion</li> <li>• conductivity and resistance – both thermal and</li> </ul>

	<p>electrical</p> <ul style="list-style-type: none"> <li>the effect of manufacturing and construction processes on material properties</li> </ul>
<b>Mechanical engineering</b>	Mechanical engineering is the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of mechanical products, processes, systems or services for converting energy into power and motion, materials into product and components into machines and systems
<b>Manufacturing engineering</b>	Manufacturing engineering includes conceptual development, design, manufacture, construction, implementation, installation, optimisation, commissioning and maintenance of resources and processes employed for the manufacture of product and components, machines and systems
<b>Sources of information</b>	<p>Sources of information may include:</p> <ul style="list-style-type: none"> <li>standards and codes</li> <li>MSDS</li> <li>reference texts</li> <li>manufacturer catalogues and other published information</li> <li>regulatory bodies</li> <li>technical, professional and industrial associations and societies</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to the mechanical engineering analysis task
<b>Tests of materials</b>	<p>Tests of materials include:</p> <ul style="list-style-type: none"> <li>destructive, including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, fatigue and peel resistance (adhesives)</li> <li>non-destructive, including hardness, ultrasonics, X-ray, die penetrant, eddy current, surface friction, conductivity, heat expansion, photoelastic, heat capacity refractive index and magnetic hysteresis loop</li> </ul>
<b>Traceability</b>	Test calibrations can be traced back to the relevant base unit in the relevant measurement system

## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.



# **MEM23064A Select and test mechatronic engineering materials**

## **Modification History**

Release 1 - New unit. Replaces MEM23062A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge needed to interpret design information for material and material test requirements, select appropriate tests and use results in the selection of appropriate materials for mechatronic engineering-related applications.

## **Application of the Unit**

This unit applies to the selection and implementation of materials and material tests relevant to mechatronic, maintenance, electronic, electrical, instrumentation and control engineering, including identifying sources of information on engineering materials, tests and test equipment. It also applies to reporting and documenting materials test and design data according to procedures.

Activities may be performed as a member of a design and development team.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A Apply technical mathematics

MEM23109A Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Identify classes and types of materials and test equipment relevant to mechatronic engineering applications	1.1	Relate material properties to common mechatronic-related methods and processes
		1.2	Identify common characteristics, faults or flaws in materials, components and product in particular engineering applications
		1.3	Identify engineering-related test methods for materials and components or product properties
		1.4	Identify specific industrial test standards/codes, calibration requirements, regulations and authorities related to selection of materials and products for mechatronic engineering applications
2	Identify and use sources of information on engineering materials, materials tests and test equipment	2.1	Review design information for material specifications and required material tests
		2.2	Identify and use appropriate sources of information on materials, materials tests and test calibration
		2.3	Identify and use appropriate sources of information on methods of testing of properties of materials
		2.4	Investigate and report on the use of relevant standards and codes
		2.5	Identify and use appropriate sources of information on material safety data sheets (MSDS)
3	Specify and implement methods used to test or obtain the properties of	3.1	Specify required materials tests and manage implementation of tests to ensure quality, safety and suitability for applications
		3.2	Ensure traceability of measurement standard

engineering materials	3.3	Obtain test sheets or certificates for appropriate materials for applications in accordance with organisational procedures and/or codes and regulations
	3.4	Obtain appropriate MSDS for applications in accordance with organisational procedures and/or codes and regulations
4 Select and implement materials and components for mechatronic engineering applications	4.1	Select materials for use in given mechatronic engineering applications based on relevant test information
	4.2	Incorporate materials and components into mechatronic processes in accordance with design functional requirements
5 Report on and record materials design data and methods and results of materials tests	5.1	Report and record materials selections against design functional requirements in accordance with organisational procedures, codes and regulations
	5.2	Include environmental impact and sustainability assessment
	5.3	Report and record materials tests and test sheets/certificates in accordance with organisational procedures, codes and regulations, including appropriate calibration and traceability
	5.4	Report and record appropriate MSDS for applications in accordance with organisational procedures, codes and regulations

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting class of materials suitable for mechatronic applications based on comparison of material properties

- identifying for common characteristics, faults or flaws in materials
- identifying test methods for properties of, and faults and flaws in, materials and components
- identifying specific industrial test standards and regulations for materials and particular engineering applications
- selecting the most appropriate tests from a range of possible tests
- identifying and applying standards and regulations for materials and components
- sourcing and using materials test sheets and certificates
- sourcing and implementing MSDS
- implementing tests correctly for materials and component properties and faults
- interpreting design documentation for materials and materials testing requirements
- addressing environmental and sustainability requirements related to material selection
- reporting, recording and filing test reports and documentation
- implementing materials tests and test sheets/certificates, test calibration and traceability

## Required knowledge

Required knowledge includes:

- properties of materials classes
- the effect of material properties, faults and flaws on mechatronic engineering methods and processes
- test methods and procedures for materials and components, including specific industrial test standards, regulations and authorities related to particular engineering applications
- sources and uses of information on materials and materials tests, including test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing MSDS
- significance of test sheets/certificates to applications
- significance of MSDS and relevance of procedures
- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test procedures, reports and documentation to applications, including the need for obtaining and filing test sheets and certificates
- significance of test calibration and traceability

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select and test mechatronic engineering
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	materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• review mechatronic design information for materials and materials test requirements</li> <li>• select classes of materials relevant to design for further research, testing and evaluation</li> <li>• identify mechatronic engineering-related standards, codes and regulatory requirements relevant to materials testing and application</li> <li>• specify appropriate tests and interpret test results for material selection</li> <li>• select materials consistent with test results and design and regulatory requirements</li> <li>• ensure traceability in material selection process</li> <li>• correctly document all results and tests.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> <li>• This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing mechatronic engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of</li> </ul>

	<p>process.</p> <ul style="list-style-type: none"> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Classes and types of materials</b>	<p>Classes and types of materials include:</p> <ul style="list-style-type: none"> <li>• non-ferrous metals and alloys</li> <li>• ferrous metals</li> <li>• non-metals (e.g. timber, concrete, ceramics, polymers and fabrics, adhesives, fibres and lubricants)</li> <li>• thermal and electrical conductors and insulators</li> <li>• semiconductors</li> <li>• substrates</li> <li>• cables and cable supports</li> <li>• fluids and lubricants</li> </ul>
<b>Properties and characteristics of materials</b>	<ul style="list-style-type: none"> <li>• Properties and characteristics of materials may include:</li> <li>• physical properties (e.g. strength, elasticity, plasticity, malleability, hardness, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation – use of plastic fillers to enhance UV resistance – and adhesion)</li> <li>• electrical related properties (e.g. resistivity, conductivity, electro-magnetic, i.e. permeability, permittivity and electro-static susceptibility)</li> </ul>

	<ul style="list-style-type: none"> <li>• thermal, chemical and optical</li> <li>• material structure and effect on properties</li> <li>• susceptibility to corrosion</li> <li>• effects of manufacturing and construction processes on material properties</li> </ul>
<b>Mechatronic engineering</b>	<p>Mechatronics is usually defined as the integration of mechanical, electronics, programming, electrical and fluid power in an engineering product. The skills and underpinning knowledge of mechatronics are common with general automation of processes, systems and services. The definition of mechatronics is here broadened to include general automation.</p>
<b>Sources of information</b>	<p>Sources of information may include:</p> <ul style="list-style-type: none"> <li>• standards and codes</li> <li>• MSDS</li> <li>• reference texts</li> <li>• manufacturer catalogues and other published information</li> <li>• regulatory bodies</li> <li>• technical, professional and industrial associations and societies</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to the mechatronic engineering analysis task</p>
<b>Tests of materials</b>	<p>Tests of materials include:</p> <ul style="list-style-type: none"> <li>• destructive, including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, fatigue and peel resistance (adhesives)</li> <li>• non-destructive, including hardness, ultrasonics, X-ray, die penetrant, eddy current, surface friction, conductivity, heat expansion, photo-elastic, heat capacity refractive index and magnetic hysteresis loop</li> <li>• electrical-related testing (e.g. conductivity, insulation, earthing resistance and safety)</li> </ul>
<b>Traceability</b>	<p>Test calibrations can be traced back to the relevant base unit in the relevant measurement system</p>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.



## **MEM23073A Select and apply aeronautical engineering methods, processes and construction techniques**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers selecting appropriate methods, processes and construction techniques within aeronautical engineering.

### **Application of the Unit**

Applications of this unit include identifying the range of manufacturing and construction methods and processes required for aeronautical engineering applications; identifying sources of information on methods and processes; selecting methods and processes; and specifying or implementing methods and processes for applications.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA340A	Lay out and set up aircraft systems
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### **Employability Skills Information**

This unit contains employability skills

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Research and categorise methods, processes and construction techniques for aeronautical applications                                | <ul style="list-style-type: none"><li>1.1 Research and categorise methods, processes and construction techniques for aeronautical engineering applications using appropriate information sources</li><li>1.2 Identify methods, processes and construction techniques to suit continuous production, mass, batch or jobbing shop production, prototype applications</li><li>1.3 Identify applications suitable for sequential or work cell manufacture or assembly</li><li>1.4 Identify manufacturing requirements of total quality management (TQM), just in time (JIT) and competitive (lean manufacturing) environments</li></ul>   |
| 2 Evaluate and select appropriate methods, processes and construction techniques for particular aeronautical engineering applications | <ul style="list-style-type: none"><li>2.1 Consider or apply appropriate scientific principles to enable methods, processes and construction techniques choices</li><li>2.2 Provide for appropriate materials properties knowledge in methods, processes and construction techniques choices</li><li>2.3 Implement appropriate materials handling procedures, including compliance with occupational health and safety (OHS) and environment requirements, legislative and regulatory requirements</li><li>2.4 Use appropriate calculations and assumptions to enable methods, processes and construction techniques choices</li><li>2.5 Apply appropriate waste and pollution treatment and recycling techniques and policies to applications</li><li>2.6 Consider suitability of application to continuous production, mass, batch or jobbing shop production, prototyping sequential or work cell manufacture or assembly appropriately in choice of methods, processes and construction techniques</li><li>2.7 Research and evaluate manufacturing requirements of TQM, JIT, group technology and competitive (lean manufacturing) environments for a range of applications</li><li>2.8 Select and evaluate measurement and test methods</li></ul> |

for particular product or process outputs

- |  |  |
|--|--|
| 3 Specify and implement methods, processes and construction techniques for aeronautical engineering applications | 3.1 Select, specify and implement applicable methods, processes and construction techniques for particular aeronautical applications |
| 4 Apply basic workshop knowledge and skills relevant to aeronautical engineering applications                    | 4.1 Identify the range and applications of basic workshop skills   |
|  | 4.2 Demonstrate relevant basic workshop skills   |
|  | 4.3 Apply appropriate basic workshop skills to particular engineering applications   |

## Required Skills and Knowledge

Required knowledge includes:

- methods and results of research and categorising of methods, processes and construction techniques for engineering applications
- methods of accessing and using alternative information sources
- applications for methods, processes and construction techniques
- applications suitable for continuous, mass, batch or jobbing shop production, work cell or sequential manufacture and assembly
- applications suitable for a range of materials handling techniques
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- the reasons for considering or using particular scientific principles
- the provision for particular materials properties in the choice of methods, processes and construction techniques
- the use of particular materials handling procedures
- reasons for compliance with regulations, standard procedures and MSDS specifications
- the reasons for using particular calculations and assumptions
- effects of waste and pollution from the application on the environment
- options for treatment and recycling as well as future developments that might be incorporated at a later date
- the suitability of application to particular continuous, mass, batch, jobbing shop, sequential or cellular manufacture and assembly
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- measurement and test methods for product or process output
- specification and implementation process for methods, processes and construction

techniques in particular applications in the context of manufacturing requirements

- manufacturing requirements, including volume considerations, TQM, JIT and competitive (lean) manufacturing
- applications for particular basic workshop skills
- procedures used in the application of skills
- OHS procedures for basic workshop skills

Required skills include:

- applying research and categorising methods, processes and construction techniques for engineering applications
- using equipment suppliers' printed data and websites
- applying methods, processes and construction techniques
- documenting applications suitable for continuous, mass, batch or jobbing shop production, work cell or sequential manufacture and assembly
- documenting applications suitable for a range of materials handling techniques
- researching and documenting manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- selecting scientific principles in the choice of methods, processes and construction techniques
- identifying materials properties in the choice of methods, processes and construction techniques
- using appropriate materials handling techniques
- handling and storing materials and products in accordance with regulations, standard procedures and material safety data sheets (MSDS) specifications
- applying waste and pollution treatment and recycling techniques and policies applications to meet code and regulatory requirements
- selecting methods, processes and construction techniques consistent with continuous, mass, batch, jobbing, prototype, sequential or cellular production process requirements
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- evaluating measurement and test methods for product or process output
- specifying and implementing methods, processes and construction techniques in an efficient and optimal manner for manufacturing requirements
- applying workshop skills for a range of applications
- applying OHS practices
- selecting appropriate workshop skills for particular engineering applications

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to select and apply aeronautical engineering methods, processes and construction techniques.</p> <p>Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and applying aeronautical engineering methods, processes and construction techniques or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Methods, processes and construction techniques</b>	<p>Methods, processes and construction techniques may include:</p> <ul style="list-style-type: none"> <li>• casting, moulding and forming</li> <li>• metal hot and cold working</li> <li>• fabricating, machining and hand working</li> <li>• materials handling/moving/storing</li> <li>• waste and pollution treatment and recycling</li> </ul>
<b>Aeronautical engineering</b>	<p>Aeronautical engineering refers to:</p> <ul style="list-style-type: none"> <li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li> </ul>
<b>Information sources</b>	<p>Information sources may include:</p> <ul style="list-style-type: none"> <li>• reference texts</li> <li>• manufacturer catalogues and industrial magazines</li> <li>• websites</li> <li>• use of phone, email and fax information gathering</li> </ul>
<b>Total quality management (TQM)</b>	<p>TQM refers to:</p> <ul style="list-style-type: none"> <li>• a customer driven amalgamation of quality assurance, quality control and quality improvement</li> </ul> <p>Tools of TQM include:</p> <ul style="list-style-type: none"> <li>• flow charts</li> <li>• Pareto</li> <li>• Ishikawa (cause and effect)</li> <li>• process capability analysis</li> <li>• sampling and control charting</li> <li>• run charts</li> <li>• correlation analysis</li> </ul>
<b>JIT</b>	<p>JIT refers to:</p> <ul style="list-style-type: none"> <li>• a system of ordering, manufacturing and supply of raw material, component parts and product at the point in time required by the process system or service. The objective is to minimise buffer stocks and inventory and the associated costs of buffer stocks and inventory</li> </ul>
<b>Competitive (lean) manufacturing principles and techniques</b>	<p>Competitive (lean) manufacturing principles and techniques refers to:</p> <ul style="list-style-type: none"> <li>• an integrated approach to manufacturing aimed at</li> </ul>

	<p>competing for market share by maximising efficiency and minimising cost by comparison with alternative manufacturers</p> <p>Techniques used include:</p> <ul style="list-style-type: none"><li>• sequential and cellular manufacture and assembly with multi-skilling of work teams, workplace improvement (including Kaizen, a gradual and continual improvement to products, processes, systems and services.), TQM (including use of TQM tools), JIT, quick changeover, process and productivity improvement, cost reduction, supply and demand chain management, quality optimisation, design for reliability, optimum maintenance, and computer-managed maintenance</li></ul>
<b>Aeronautical applications</b>	<p>Aeronautical applications may include:</p> <ul style="list-style-type: none"><li>• airframe and power plant support structure and structural components</li><li>• landing gear and landing gear systems and components</li><li>• aircraft mechanical systems and components</li><li>• hydraulic systems and components</li><li>• pneumatic systems and components</li><li>• fuel systems and components</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23074A Select and apply avionic engineering methods, processes and construction techniques**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers selecting appropriate methods, processes and construction techniques within avionic engineering.

### **Application of the Unit**

Applications of this unit include identifying the range of manufacturing and construction methods and processes required for avionic engineering applications, identifying sources of information on methods and processes, selecting methods and processes, and specifying or implementing methods and processes for applications.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
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### **Employability Skills Information**

This unit contains employability skills

### **Elements and Performance Criteria Pre-Content**

Not applicable.



## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Research and categorise methods, processes and construction techniques for avionic applications                                | 1.1 Research and categorise methods, processes and construction techniques for avionic engineering applications using appropriate information sources   |
|  | 1.2 Identify methods, processes and construction techniques to suit continuous production, mass, batch or jobbing shop production, prototype applications   |
|  | 1.3 Identify applications suitable for sequential or work cell manufacture or assembly  |
|  | 1.4 Identify manufacturing requirements of total quality management (TQM), just in time (JIT) and competitive (lean manufacturing) environments   |
| 2 Evaluate and select appropriate methods, processes and construction techniques for particular avionic engineering applications | 2.1 Consider or apply appropriate scientific principles to enable methods, processes and construction techniques choices  |
|  | 2.2 Provide for appropriate materials properties knowledge in methods, processes and construction techniques choices  |
|  | 2.3 Implement appropriate materials handling procedures, including compliance with occupational health and safety (OHS) environmental, legislative and regulatory requirements  |
|  | 2.4 Use appropriate calculations and assumptions to enable methods, processes and construction techniques choices   |
|  | 2.5 Apply appropriate waste and pollution treatment and recycling techniques and policies to applications   |
|  | 2.6 Consider suitability of application to continuous production, mass, batch or jobbing shop production, prototyping sequential or work cell manufacture or assembly in choice of methods, processes and construction techniques |
|  | 2.7 Research and evaluate manufacturing requirements of TQM, JIT, group technology and competitive (lean manufacturing) environments for a range of applications  |

- |   |   |
|---|---|
|   | 2.8 Evaluate and select measurement and test methods for particular product or process outputs                                  |
| 3 Specify and implement methods, processes and construction techniques for avionic engineering applications | 3.1 Select, specify and implement applicable methods, processes and construction techniques for particular avionic applications |
| 4 Apply basic workshop knowledge and skills relevant to avionic engineering applications                    | 4.1 Identify the range and applications of basic workshop skills  |
|   | 4.2 Demonstrate relevant basic workshop skills  |
|   | 4.3 Apply appropriate basic workshop skills to particular engineering applications  |

## Required Skills and Knowledge

Required knowledge includes:

- methods and results of research and categorising of methods, processes and construction techniques for engineering applications, including:
  - electrical wiring and loom specification and construction:
    - selection of wire material and gauge
    - selection of insulation type
    - selection of wire marking system and method
    - specification of wire length and loom routing requirements
    - selection of termination methods
    - selection and specification of testing requirements
- thermocouple harness material selection, construction methods and test requirements
- data cable (selection of cable type, including fibre optic, selection of termination hardware, determination of length and routing requirements, construction method and test requirements)
- antenna cables and pulse system transmission lines:
  - determination of performance characteristics
  - selection of antenna cable/transmission line materials
  - selection of termination hardware
  - determination of cable length and routing requirements
  - specification of test requirements
- HF radio antenna design and construction
- design principles, material selection, construction methods and test requirements for single and multi-layer printed circuit boards

- metallic and non-metallic materials and construction methods for avionic component covers and requirements and attachment methods for mounts
- design and construction methods for instrument panels, including layout, ergonomic considerations, materials, mounting requirements and lighting systems
- methods of accessing and using alternative information sources
- applications for methods, processes and construction techniques
- applications suitable for continuous, mass, batch or jobbing shop production, work cell or sequential manufacture and assembly
- applications suitable for range of materials handling techniques
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- reasons for considering or using particular scientific principles
- the provision for particular materials properties in the choice of methods, processes and construction techniques
- the use of particular materials handling procedures and reasons for compliance with regulations, standard procedures and MSDS specifications
- reasons for using particular calculations and assumptions
- effects of waste and pollution from the application on the environment
- options for treatment and recycling as well as future developments that might be incorporated at a later date
- suitability of applications to particular continuous, mass, batch, jobbing shop, sequential or cellular manufacture and assembly
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- measurement and test methods for product or process output
- specification and implementation process for methods, processes and construction techniques in particular applications in the context of manufacturing requirements
- manufacturing requirements, including volume considerations, TQM, JIT, competitive (lean) manufacturing
- applications for particular basic workshop skills
- procedures used in the application of skills
- OHS procedures for basic workshop skills

Required skills include:

- applying research and categorising methods, processes and construction techniques for engineering applications
- using equipment suppliers' printed data and websites
- selecting applications for methods, processes and construction techniques
- documenting applications suitable for continuous, mass, batch or jobbing shop production, work cell or sequential manufacture and assembly
- documenting applications suitable for a range of materials handling techniques
- researching and documenting manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- selecting scientific principles in the choice of methods, processes and construction techniques

- identifying materials properties in the choice of methods, processes and construction techniques
- using appropriate materials handling techniques
- handling and storing materials and products in accordance with regulations, standard procedures and material safety data sheet (MSDS) specifications
- applying waste and pollution treatment and recycling techniques and policies applications to meet code and regulatory requirements
- selecting methods, processes and construction techniques consistent with continuous, mass, batch, jobbing, prototype, sequential or cellular production process requirements
- manufacturing requirements of TQM, JIT and competitive (lean manufacturing) environments
- evaluating measurement and test methods for product or process output
- specifying and implementing methods, processes and construction techniques in an efficient and optimal manner for manufacturing requirements
- applying workshop skills for a range of applications
- applying OHS practices
- selecting appropriate workshop skills for particular engineering applications

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select and apply avionic engineering methods, processes and construction techniques. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and applying avionic engineering methods, processes and construction techniques or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

<b>Methods, processes and construction techniques</b>	<p>Methods, processes and construction techniques include:</p> <ul style="list-style-type: none"> <li>• casting, moulding and forming</li> <li>• metal hot and cold working</li> <li>• fabricating, machining and hand working</li> <li>• assembly, materials handling/moving/storing</li> <li>• waste and pollution treatment and recycling</li> </ul>
<b>Avionic engineering</b>	<p>Avionic engineering refers to:</p> <ul style="list-style-type: none"> <li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li> </ul>
<b>Information sources</b>	<p>Information sources includes:</p> <ul style="list-style-type: none"> <li>• reference texts</li> <li>• manufacturer catalogues and industrial magazines</li> <li>• websites,</li> <li>• use of phone, email and fax information gathering</li> </ul>
<b>TQM</b>	<p>TQM refers to:</p> <ul style="list-style-type: none"> <li>• a customer driven amalgamation of quality assurance, quality control and quality improvement</li> </ul> <p>Tools of TQM include:</p> <ul style="list-style-type: none"> <li>• flow charts</li> <li>• Pareto</li> <li>• Ishikawa (cause and effect)</li> <li>• process capability analysis</li> <li>• sampling and control charting</li> <li>• run charts</li> <li>• correlation analysis</li> </ul>
<b>JIT</b>	<p>JIT is a system of ordering, manufacturing and supply of raw material, component parts and product at the point in time required by the process system or service. The objective is to minimise buffer stocks and inventory and the associated costs of buffer stocks and inventory</p>
<b>Competitive (lean) manufacturing principles and techniques</b>	<p>Competitive (lean) manufacturing principles and techniques refer to:</p> <ul style="list-style-type: none"> <li>• an integrated approach to manufacturing aimed at competing for market share by maximising efficiency and minimising cost by comparison with alternative manufacturers</li> </ul>

	<p>Techniques used include:</p> <ul style="list-style-type: none"><li>• sequential and cellular manufacture and assembly with multi-skilling of work teams, workplace improvement (including Kaizen, a gradual and continual improvement to products, processes, systems and services.), TQM( including use of TQM tools), JIT, quick changeover, process and productivity improvement, cost reduction, supply and demand chain management, quality optimisation, design for reliability, optimum maintenance, and computer-managed maintenance</li></ul>
<b>Avionic applications</b>	<p>Avionic applications may include:</p> <ul style="list-style-type: none"><li>• wiring, including assembly into looms and termination techniques,</li><li>• thermocouple harnesses</li><li>• data cables, including fibre optic</li><li>• communication system antenna cables and pulse system transmission lines</li><li>• HF radio antennas</li><li>• instrument panels</li><li>• printed circuit boards (single and multi-layer)</li><li>• avionic component covers and mounts</li><li>• materials handling/moving/storing</li><li>• waste and pollution treatment and recycling</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23084A Apply scientific principles and techniques in aeronautical engineering situations**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers applying advanced scientific principles to aeronautical engineering situations.

### **Application of the Unit**

This unit applies to selecting and applying advanced aeronautical scientific principles and techniques.

Computer techniques, graphical methods and mathematical calculations should complement scientific principles chosen and include unit analysis, appropriate precision and accuracy and use conservative estimations.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA349A	Apply basic scientific principles and techniques in aeronautical engineering situations
MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations

### **Employability Skills Information**

This unit contains employability skills



## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |  |   |
|--|---|
| 1 Identify the range of aeronautical scientific principles and techniques relevant to aeronautical engineering | 1.1 Research and report on aeronautical scientific principles relating to aeronautical engineering using appropriate sources of information   |
|  | 1.2 Research and report on aeronautical techniques and associated technologies, software and hardware associated with implementing scientific principles relating to aeronautical engineering applications using appropriate sources of information |
| 2 Select scientific principles and techniques relevant to aeronautical engineering applications                | 2.1 Select the relevant scientific principles for particular aeronautical engineering situations  |
|  | 2.2 Select the relevant aeronautical techniques and associated technologies, software and hardware for particular aeronautical engineering situations   |
| 3 Apply the relevant scientific principles and techniques appropriately  | 3.1 Apply the scientific principles in a consistent and appropriate manner to obtain any required solution  |
|  | 3.2 Use appropriate calculations and correct units to establish quantities  |
|  | 3.3 Use coherent units in equations in a systematic manner to ensure meaningful solutions   |
|  | 3.4 Use significant figures in engineering calculations   |
|  | 3.5 Apply the techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions   |
| 4 Quote the results of the application of the aeronautical scientific principles and techniques correctly      | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style   |
|  | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style   |

## Required Skills and Knowledge

Required knowledge includes:

- aeronautical techniques and related technologies, software and hardware associated with implementing scientific principles in engineering solutions and related to appropriate engineering applications. Principles include:
  - physics:
    - momentum and center of gravity
    - gravity
    - circular motion
    - orbital motion
    - rotational motion
    - oscillation and simple harmonic motion
  - digital electronics:
    - logic circuits
    - logic families
    - construction and testing techniques
    - flip flop circuits
    - analogue to digital conversion
    - digital to analogue conversion
    - timing and control
    - circuit analysis
  - stress analysis:
    - 2D force systems
    - equilibrium in 2D
    - plane trusses
    - plane frames and machines
    - 3D force systems
    - equilibrium in 3D
    - space trusses and frames
    - properties of areas
    - engineering concepts of stress and strain
    - axial force and deformation
    - shear force and deformation
    - thin walled pressure vessels
    - 2D stress
    - 2D strain
    - relationship between elastic constants
    - joints
    - instability

- stress concentration
- mechanics of flight:
  - boundary layer calculations relating to drag coefficient and skin friction
  - lift augmentation
  - thrust and power available
  - range and endurance
  - static stability
  - supersonic aerodynamics
  - rotary wing aerodynamics
- aircraft dynamic stability:
  - states of stability
  - the aerodynamic derivatives employed in the aircraft equations of motion
  - aircraft longitudinal stability
  - lateral dynamic stability
  - control mechanisms
  - aeroelastic effects
- aircraft mechanisms:
  - friction mechanisms
  - linkages
  - bearings
  - gear mechanisms
  - mechanical vibration
  - static and dynamic balancing
- limitations of aeronautical techniques and associated technologies, software and hardware
- relevance of scientific principles to aeronautical engineering
- applicability and limitations of an extensive range of aeronautical techniques and associated technologies, software and hardware
- choice of aeronautical scientific principles for particular applications
- applicability of particular aeronautical techniques and associated technologies, software and hardware to specific applications
- choice of aeronautical techniques and associated technologies, software and hardware for particular applications
- the method of application of the scientific principles
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations

- procedures for estimating errors in derived quantities
- the method of application of the aeronautical techniques and associated technologies, software and hardware
- significance of the calculation solution style in relation to the original task
- significance of the non-calculation solution style in relation to the original task

Required skills include:

- applying advanced scientific principles relevant to aeronautical engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which aeronautical scientific principles are selected
- selecting appropriate aeronautical techniques and associated technologies, software and hardware to suit applications
- applying appropriate aeronautical principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying aeronautical techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application
- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

## Evidence Guide

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply scientific principles and techniques in aeronautical engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying scientific principles and techniques in aeronautical engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

<b>Aeronautical engineering</b>	<p>Aeronautical engineering refers to:</p> <ul style="list-style-type: none"><li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li></ul>
<b>Sources of information</b>	<p>Sources of information includes:</p> <ul style="list-style-type: none"><li>reference texts</li><li>manufacturer catalogues and industrial magazines</li><li>websites</li><li>use of phone, email and fax information gathering</li></ul>
<b>Aeronautical engineering applications</b>	<p>Aeronautical engineering applications refer to:</p> <ul style="list-style-type: none"><li>the description or definition of an objective or challenge within a real or simulated engineering environment or state requiring a conceptual development, design, manufacture and/or implementation and/or installation, commissioning and maintenance response to affect a solution or improvement with regard to:<ul style="list-style-type: none"><li>airframe structure including power plant support structure</li><li>mechanical systems, including flight controls</li><li>hydraulic systems, including powered flight controls</li><li>pneumatic systems, including pressurisation and air conditioning systems</li><li>the interfaces between hydro-mechanical systems, including engine controls, and electrical and electronic control systems</li><li>the interface between hydro-mechanical flight control systems and automatic flight control systems</li></ul></li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23086A Apply scientific principles and techniques in avionic engineering situations**

### **Modification History**

Release 1 - New unit. Based on and equivalent to MEM23085A

### **Unit Descriptor**

This unit of competency covers applying advanced scientific principles to avionic engineering situations.

### **Application of the Unit**

This unit applies to selecting and applying advanced avionic scientific principles and techniques.

Computer techniques, graphical methods and mathematical calculations should complement scientific principles chosen and include unit analysis, appropriate precision and accuracy, and use conservative estimations.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA272A	Apply basic scientific principles and techniques in aeronautical engineering situations
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### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential	Performance criteria describe the performance needed
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outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Identify the range of scientific principles and techniques relevant to avionic engineering	1.1	Identify the scientific principles relating to avionic engineering
		1.2	Research and report on avionic scientific principles using appropriate sources of information
		1.3	Identify the techniques and associated technologies, software and hardware associated with implementing scientific principles relating to avionic engineering applications
		1.4	Research and report on avionic techniques using appropriate sources of information
2	Select scientific principles and techniques	2.1	Select relevant scientific principles for specific avionic engineering situations
		2.2	Select relevant avionic techniques and associated technologies, software and hardware for specific avionic engineering situations
3	Apply the relevant scientific principles and techniques	3.1	Apply applicable scientific principles in a consistent and appropriate manner to obtain any required solution
		3.2	Use appropriate calculations and correct units to establish quantities
		3.3	Use coherent units in equations in a systematic manner to ensure meaningful solutions
		3.4	Use significant figures in engineering calculations
		3.5	Obtain required solutions by applying chosen techniques and associated technologies, software and hardware in a consistent and appropriate manner

4	Document the results of the application of the avionic scientific principles and techniques	4.1	Document solutions involving engineering calculations in an appropriate style
		4.2	Document solutions not involving engineering calculations in an appropriate style

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- applying advanced scientific principles relevant to avionic engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which avionic scientific principles are selected
- selecting appropriate avionic techniques and associated technologies, software and hardware to suit the application/s
- applying appropriate avionic principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying avionic techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application
- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

### Required knowledge

Required knowledge includes:

- physics – analysis and application of:
  - linear kinematics
  - planar kinematics
  - Newton's Laws of Motion
  - friction
  - momentum and center of gravity
  - gravity

- circular motion
- orbital motion
- rotational motion
- oscillation
- electronic fundamentals – determination of required values and characteristics for:
  - resistors (including light and voltage dependent resistors)
  - capacitors
  - inductors
  - transformers
  - diodes
  - transistors
  - power amplifiers
  - oscillators
  - silicon controlled rectifiers
  - thyristor power control circuits
  - opto-couplers
- selection of appropriate test equipment
- digital electronics – design, construction and testing of:
  - clocked sequential circuits
  - registers
  - oscillators
  - timers
  - interfacing circuits
  - program logic array
  - state machines
- data communications – analysis and application of:
  - selection of data transmission methods
  - universal asynchronous receiver transmitter construction
  - multiplexers and demultiplexers
  - data encryption/decryption theory
- electronic circuit analysis involving the application of:
  - Fourier Transforms
  - Laplace Transforms
- aerodynamics – application of:
  - drag and speed
  - power/thrust available and power/thrust required
  - manoeuvring flight
  - stability and control
- strength of materials – application of:
  - bending and shear in beams

- forces in trusses and frames
- engineering concepts of stress and strain
- properties of areas
- torsion
- mechanical properties of materials
- two dimensional stress and strain, including elastic constants
- computer software/programming – application of:
  - high level languages
  - algorithm design and testing
  - Pascal and Turbo-Pascal programming
- the limitations of avionic techniques and associated technologies, software and hardware
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- the procedures for determining the significance of figures in calculations
- the procedures for estimating errors in derived quantities
- the method of application of the avionic techniques and associated technologies, software and hardware
- the application of the calculation solution style
- the significance of the non-calculation solution style

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	Evidence should be provided through the application of scientific principles and techniques in a range of avionic engineering situations.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors should ensure that candidates can: <ul style="list-style-type: none"><li>• consistently select and apply appropriate scientific principles in avionic engineering situations</li><li>• document in an appropriate style the solutions obtained through the application of chosen scientific principles in avionic engineering situations.</li></ul>
<b>Context of and specific resources</b>	<ul style="list-style-type: none"><li>• Assessment may occur on the job or in an appropriately simulated environment. Access is</li></ul>

<b>for assessment</b>	<p>required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and work health and safety (WHS) and environment practices.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>Sources of information</b>	<b>Sources of information include:</b> <ul style="list-style-type: none"><li>• reference texts</li><li>• manufacturer catalogues and industrial magazines</li><li>• internet search engines and websites</li><li>• email</li><li>• the use of phone and fax</li><li>• airworthiness and design authority regulations and associated advisory material</li></ul>
<b>Avionic engineering</b>	<b>Avionic engineering is:</b> <ul style="list-style-type: none"><li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li></ul>
<b>Avionic engineering applications</b>	<b>Avionic engineering applications are defined as:</b> <ul style="list-style-type: none"><li>• the description or definition of an objective or challenge within a real or simulated engineering environment or state requiring a conceptual development, design, manufacture and/or implementation and/or installation, commissioning and maintenance response to affect a solution or improvement with regard to:<ul style="list-style-type: none"><li>• electrical systems and related wiring and components (power generation, distribution, control interfaces with hydraulic and pneumatic systems, and caution and warning systems)</li><li>• mechanical and electro-mechanical flight instruments and indication systems (quantity, pressure, temperature, position) and components</li><li>• electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management, and engine management)</li><li>• automatic test stations, adapters and software</li></ul></li></ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.

## **MEM23095A Apply aeronautical system design principles and techniques in aeronautical engineering situations**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers aeronautical system design principles in aeronautical engineering situations.

### **Application of the Unit**

This unit applies to selecting and applying aeronautical system design principles and techniques appropriate to aeronautical engineering applications.

Computer techniques, graphical methods and mathematical calculations should complement scientific principles chosen and include unit analysis, appropriate precision and accuracy, and use conservative estimations.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA349A	Apply basic scientific principles and techniques in aeronautical engineering
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### **Employability Skills Information**

This unit contains employability skills

### **Elements and Performance Criteria Pre-Content**

Not applicable.



## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Identify the range of aeronautical system design principles and techniques relevant to aeronautical engineering | 1.1 Research and report on aeronautical system design principles using appropriate sources of information   |
|   | 1.2 Identify the aeronautical system design principles relating to aeronautical engineering applications  |
|   | 1.3 Research and report on aeronautical system design techniques and associated technologies, software and hardware associated with implementing scientific principles relating to aeronautical engineering applications using appropriate sources of information |
| 2 Select aeronautical system design principles and techniques relevant to aeronautical engineering applications   | 2.1 Select the relevant aeronautical system design principles for particular aeronautical engineering situations  |
|   | 2.2 Select the relevant aeronautical system design techniques and associated technologies, software and hardware for particular aeronautical engineering situations   |
| 3 Apply the relevant aeronautical system design principles and techniques appropriately                           | 3.1 Apply the aeronautical system design principles in a consistent and appropriate manner to obtain any required solution  |
|   | 3.2 Use appropriate calculations and correct units to establish quantities  |
|   | 3.3 Use coherent units in equations in a systematic manner to ensure meaningful solutions   |
|   | 3.4 Use significant figures are used in engineering calculations  |
|   | 3.5 Apply the aeronautical system design techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions  |
| 4 Quote the results of the application of the aeronautical system design principles and techniques correctly      | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style   |
|   | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style   |

## Required Skills and Knowledge

Required knowledge includes:

- aeronautical engineering techniques and related technologies, software and hardware associated with implementing scientific principles in engineering solutions and related to appropriate engineering applications
- the limitations of aeronautical engineering techniques and associated technologies, software and hardware
- the relevance of scientific principles to aeronautical engineering
- the applicability and limitations of an extensive range of aeronautical engineering techniques and associated technologies, software and hardware
- the choice of aeronautical engineering scientific principles for particular applications
- the applicability of particular aeronautical engineering techniques and associated technologies, software and hardware to specific applications
- the choice of aeronautical engineering techniques and associated technologies, software and hardware for particular applications
- the method of application of the scientific principles
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities
- the method of application of the aeronautical engineering techniques and associated technologies, software and hardware
- the significance of the calculation solution style in relation to the original task
- the significance of the non-calculation solution style in relation to the original task

Required skills include:

- applying advanced scientific principles relevant to aeronautical engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which aeronautical engineering scientific principles are selected
- selecting appropriate aeronautical engineering techniques and associated technologies, software and hardware to suit the application/s
- applying appropriate aeronautical engineering principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying aeronautical engineering techniques and associated technologies, software and

hardware in a manner appropriate to the application and identified scientific principles

- referring solutions to the original aim of the application
- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply aeronautical system design principles and techniques in mechanical engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying aeronautical system design principles and techniques in aeronautical engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Aeronautical systems</b>	Aeronautical systems may include: <ul style="list-style-type: none"><li>• hydraulic systems (utility and flight control)</li><li>• pneumatic systems</li><li>• mechanical systems</li><li>• air and vapour cycle air conditioning systems</li><li>• pressurisation systems</li><li>• fuel storage and distribution systems</li><li>• fire extinguishing systems</li></ul>
<b>Sources of information</b>	Sources of information include: <ul style="list-style-type: none"><li>• reference texts</li><li>• manufacturer catalogues and industrial magazines</li><li>• websites</li><li>• use of phone, email and fax information gathering</li></ul>
<b>Aeronautical engineering</b>	Aeronautical engineering refers to: <ul style="list-style-type: none"><li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li></ul>
<b>Aeronautical engineering situations</b>	Aeronautical engineering situations may include: <ul style="list-style-type: none"><li>• working as a member of a design team</li><li>• developing repair schemes</li><li>• developing modifications</li><li>• designing test equipment</li><li>• developing fault trees/diagnosis guides</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23096A Apply avionic system design principles and techniques in avionic engineering situations**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers avionic system design principles in avionic engineering situations.

### **Application of the Unit**

This unit applies to selecting and applying avionic system design principles and techniques appropriate to avionic engineering applications.

Computer techniques, graphical methods and mathematical calculations should complement scientific principles chosen and include unit analysis, appropriate precision and accuracy, and use conservative estimations.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
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### **Employability Skills Information**

This unit contains employability skills

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Identify the range of avionic system design principles and techniques relevant to avionic engineering | 1.1 Research and report on avionic system design principles using appropriate sources of information  |
|   | 1.2 Identify the avionic system design principles relating to avionic engineering applications  |
|   | 1.3 Research and report on avionic system design techniques and associated technologies, software and hardware associated with implementing scientific principles relating to avionic engineering applications using appropriate sources of information |
| 2 Select avionic system design principles and techniques relevant to avionic engineering applications   | 2.1 Select the relevant avionic system design principles for particular avionic engineering situations  |
|   | 2.2 Select the relevant avionic system design techniques and associated technologies, software and hardware for particular avionic engineering situations   |
| 3 Apply the relevant avionic system design principles and techniques appropriately                      | 3.1 Apply the avionic system design principles in a consistent and appropriate manner to obtain any required solution   |
|   | 3.2 Use appropriate calculations and correct units to establish quantities  |
|   | 3.3 Use coherent units in equations in a systematic manner to ensure meaningful solutions   |
|   | 3.4 Use significant figures in engineering calculations   |
|   | 3.5 Apply the avionic system design techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions   |
| 4 Quote the results of the application of the avionic system design principles and techniques correctly | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style   |
|   | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style   |

## Required Skills and Knowledge

Required knowledge includes:

- avionic engineering techniques and related technologies, software and hardware associated with implementing scientific principles in engineering solutions and related to appropriate engineering applications
- the limitations of avionic engineering techniques and associated technologies, software and hardware
- the relevance of scientific principles to avionic engineering
- the applicability and limitations of an extensive range of avionic engineering techniques and associated technologies, software and hardware
- the choice of avionic engineering scientific principles for particular applications
- the applicability of particular avionic engineering techniques and associated technologies, software and hardware to specific applications
- the choice of avionic engineering techniques and associated technologies, software and hardware for particular applications
- the method of application of the scientific principles
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities
- the method of application of the mechanical engineering techniques and associated technologies, software and hardware
- the significance of the calculation solution style in relation to the original task
- the significance of the non-calculation solution style in relation to the original task

Required skills include:

- applying advanced scientific principles relevant to avionic engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which avionic engineering scientific principles are selected
- selecting appropriate avionic engineering techniques and associated technologies, software and hardware to suit the application/s
- applying appropriate avionic engineering principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying avionic engineering techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles



- referring solutions to the original aim of the application
- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply avionic system design principles and techniques in avionic engineering situations.</p> <p>Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying avionic system design principles and techniques in avionic engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>Avionic systems</b>	<p>Avionic systems may include:</p> <ul style="list-style-type: none"><li>• electrical systems and related wiring and components (power generation, distribution, control interfaces with hydraulic and pneumatic systems, and caution and warning systems)</li><li>• mechanical and electro-mechanical flight instruments and indication systems (quantity, pressure, temperature and position) and components</li><li>• electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management and engine management)</li><li>• automatic test stations, adapters and software</li></ul>
<b>Sources of information</b>	<p>Sources of information include:</p> <ul style="list-style-type: none"><li>• reference texts</li><li>• manufacturer catalogues and industrial magazines</li><li>• websites</li><li>• use of phone, email and fax information gathering</li></ul>
<b>Avionic engineering</b>	<p>Avionic engineering refers to:</p> <ul style="list-style-type: none"><li>• the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li></ul>
<b>Avionic engineering situations</b>	<p>Avionic engineering solutions may include:</p> <ul style="list-style-type: none"><li>• working as a member of a design team</li><li>• developing modifications to systems and components</li><li>• designing and constructing test equipment</li><li>• writing test procedures and programs</li><li>• developing fault trees/fault diagnosis guides</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23097A Apply automated systems principles and techniques in aeronautical engineering situations**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers applying scientific principles and techniques to automated systems in aeronautical engineering.

### **Application of the Unit**

This unit applies to selecting and applying automated systems principles and techniques. It includes identifying characteristics of automated systems and related principles and techniques, selecting principles and techniques for particular automated systems, applying principles and techniques to automated systems, quoting results.

Applications may include participation in aeronautical system design, development of modifications, development and support of fault tree and fault diagnosis guides, and test equipment development or modification.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23052A	Apply basic electro and control scientific principles and techniques in aeronautical engineering situations
MEA349A	Apply basic scientific principles and techniques in aeronautical engineering

### **Employability Skills Information**

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Identify the range of principles and techniques relevant to automated systems                 | 1.1 Research and report on automated systems engineering techniques and associated technologies, software and hardware associated with implementing scientific principles relating to automated systems applications using appropriate sources of information |
|   | 1.2 Identify regulatory requirements associated with automated systems  |
| 2 Select principles and techniques relevant to automated systems applications                   | 2.1 Select the relevant principles for particular automated systems situations the relevant principles  |
|   | 2.2 Select the relevant techniques and associated technologies, software and hardware for particular automated systems situations   |
| 3 Apply the relevant automated systems principles and techniques appropriately                  | 3.1 Apply the principles in a consistent and appropriate manner to obtain any required solution   |
|   | 3.2 Use appropriate calculations and correct units to establish quantities  |
|   | 3.3 Use coherent units in equations in a systematic manner to ensure meaningful solutions   |
|   | 3.4 Use significant figures in engineering calculations   |
|   | 3.5 Apply the techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions   |
| 4 Quote the results of the application of automated systems principles and techniques correctly | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style   |
|   | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style   |

## Required Skills and Knowledge

Required knowledge includes:

- aeronautical systems techniques and related technologies, software and hardware associated with implementing scientific principles in engineering solutions and related to appropriate engineering applications
- the limitations of aeronautical systems techniques and associated technologies, software and hardware
- the relevance of scientific principles to aeronautical systems engineering
- applicability and limitations of an extensive range of aeronautical systems techniques and associated technologies, software and hardware
- the choice of aeronautical systems scientific principles for particular applications
- applicability of particular aeronautical systems techniques and associated technologies, software and hardware to specific applications
- the choice of aeronautical systems techniques and associated technologies, software and hardware for particular applications
- the method of application of the scientific principles
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities
- the method of application of the aeronautical systems techniques and associated technologies, software and hardware
- the significance of the calculation solution style in relation to the original task
- the significance of the non-calculation solution style in relation to the original task

Required skills include:

- applying aeronautical systems principles relevant to engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which aeronautical systems principles are selected
- selecting appropriate aeronautical systems interfacing techniques and associated technologies, software and hardware to suit applications
- applying appropriate aeronautical systems principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying aeronautical systems interfacing techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific

principles

- referring solutions to the original aim of the application
- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply automated systems principles and techniques in aeronautical engineering situations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying automated systems principles and techniques in engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	



## Range Statement

<b>Automated systems</b>	<p>Automated systems refer to:</p> <ul style="list-style-type: none"><li>the engineering discipline concerned with the conceptual development, research, design, manufacture and/or implementation and/or installation, commissioning and maintenance of automated processes, systems or services for converting energy into power and motion, materials into product and components into machines and systems for domestic, commercial, industrial, civil, entertainment, medical or military applications</li></ul> <p>Automated systems may incorporate:</p> <ul style="list-style-type: none"><li>mechanical, electronics, programming, electrical and fluid power elements in a system designed to achieve a desired output in response to a variety of inputs, disturbances and variables</li></ul>
<b>Automated systems engineering techniques</b>	<p>Automated systems engineering techniques includes:</p> <ul style="list-style-type: none"><li>the use of system analysis, mechanical and electro, programming and software skills for design, installation, commissioning, troubleshooting and maintenance of systems, processes and services</li></ul> <p>Automated systems technique may be enhanced by:</p> <ul style="list-style-type: none"><li>the development of basic capabilities with hand and power tools, experience of processes and materials properties</li></ul>
<b>Automated systems applications</b>	<p>In general, principles and techniques for automated systems will include:</p> <ul style="list-style-type: none"><li>mechanical, structural, hydraulic, pneumatic, fluid pumping, electrical and electronic control principles and techniques</li></ul> <p>The control systems will typically include:</p> <ul style="list-style-type: none"><li>sensory elements, such as position, level, pressure, temperature, flow rate, pH sensors, computer, PLC or dedicated microprocessor control together with appropriate signal conditioning and actuator interfacing. Emergency stop and failsafe design should be incorporated as required</li></ul> <p>Communications may be:</p> <ul style="list-style-type: none"><li>hard-wired, telemetric, radio or phone linked</li></ul> <p>Specific aeronautical applications include:</p> <ul style="list-style-type: none"><li>the interface between powered flying controls and automatic flight control systems</li><li>the interface between engine components and full</li></ul>

	<p>authority digital engine control systems</p> <ul style="list-style-type: none"><li>• the interface between engine systems and components and engine indicating and crew alerting systems</li></ul>
<b>Sources of information</b>	<p>Sources of information include:</p> <ul style="list-style-type: none"><li>• reference texts</li><li>• relevant standards</li><li>• manufacturer catalogues and industrial magazines</li><li>• websites</li><li>• use of phone, email and fax information gathering</li></ul>
<b>Regulatory requirements</b>	<p>Regulatory requirements may be found in:</p> <ul style="list-style-type: none"><li>• Civil Aviation Regulations or Civil Aviation Safety Regulations</li><li>• Technical Airworthiness Maintenance Manual (AAP 7001.053)</li><li>• Federal Aviation Regulations (United States)</li><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

## **MEM23098A Apply automated systems principles and techniques in avionic engineering situations**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit of competency covers applying scientific principles and techniques to automated systems in avionic engineering.

### **Application of the Unit**

This unit applies to selecting and applying automated systems principles and techniques. It includes identifying characteristics of automated systems and related principles and techniques, selecting principles and techniques for particular automated systems, applying principles and techniques to automated systems, and quoting results.

Applications may include participation in avionic system design, development of modifications, development and support of fault tree and fault diagnosis guides, and test equipment development or modification.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA272A	Apply basic scientific principles and techniques in avionic engineering situations
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### **Employability Skills Information**

This unit contains employability skills

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Identify the range of principles and techniques relevant to automated systems                 | 1.1 Research and report on automated systems engineering techniques and associated technologies, software and hardware associated with implementing scientific principles relating to automated systems applications using appropriate sources of information |
|   | 1.2 Identify regulatory requirements associated with avionic automated systems  |
| 2 Select principles and techniques relevant to automated systems applications                   | 2.1 Select the relevant principles for particular automated systems situations  |
|   | 2.2 Select the relevant techniques and associated technologies, software and hardware for particular automated systems situations   |
| 3 Apply the relevant automated systems principles and techniques appropriately                  | 3.1 Apply the principles in a consistent and appropriate manner to obtain any required solution   |
|   | 3.2 Use appropriate calculations and correct units to establish quantities  |
|   | 3.3 Use coherent units in equations in a systematic manner to ensure meaningful solutions   |
|   | 3.4 Use significant figures in engineering calculations   |
|   | 3.5 Apply the techniques and associated technologies, software and hardware in a consistent and appropriate manner to obtain required solutions   |
| 4 Quote the results of the application of automated systems principles and techniques correctly | 4.1 Quote solutions for applications involving engineering calculations in an appropriate style   |
|   | 4.2 Quote solutions for applications not involving engineering calculations in an appropriate style   |

## Required Skills and Knowledge

Required knowledge includes:

- avionic systems techniques and related technologies, software and hardware associated with implementing scientific principles in engineering solutions and related to appropriate engineering applications
- the limitations of avionic systems techniques and associated technologies, software and hardware
- the relevance of scientific principles to avionic systems engineering
- applicability and limitations of an extensive range of avionic systems techniques and associated technologies, software and hardware
- the choice of avionic systems scientific principles for particular applications
- applicability of particular avionic systems techniques and associated technologies, software and hardware to specific applications
- the choice of avionic systems techniques and associated technologies, software and hardware for particular applications
- the method of application of the scientific principles
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for ensuring coherent units for meaningful solutions to equations
- the concept of significant figures
- the uncertainty of computations based on experimental data
- procedures for determining the significance of figures in calculations
- procedures for estimating errors in derived quantities
- the method of application of the avionic systems techniques and associated technologies, software and hardware
- the significance of the calculation solution style in relation to the original task
- the significance of the non-calculation solution style in relation to the original task

Required skills include:

- applying avionic systems principles relevant to engineering
- analysing the given situation to determine what is required in the manner of a solution
- analysing the given situation to determine which avionic systems principles are selected
- selecting appropriate avionic systems interfacing techniques and associated technologies, software and hardware to suit applications
- applying appropriate avionic systems principles in determining the required solution
- applying and manipulating formulas and calculations for engineering applications
- using the correct units to solve engineering calculations
- checking the validity of equations using a systematic method for ensuring coherent units
- applying avionic systems interfacing techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application

- quoting solutions in appropriate units and using appropriate significant figures
- presenting solutions referring to the original aim of the application

## Evidence Guide

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply automated systems principles and techniques in avionic engineering situations.</p> <p>Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	<p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying automated systems principles and techniques in engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Guidance information for assessment</b>	





## Range Statement

<p><b>Automated systems</b></p>	<p>Automated systems refer to:</p> <ul style="list-style-type: none"> <li>the engineering discipline concerned with the conceptual development, research, design, manufacture and/or implementation and/or installation, commissioning and maintenance of automated processes, systems or services for converting energy into power and motion, materials into product and components into machines and systems for domestic, commercial, industrial, civil, entertainment, medical or military applications</li> </ul> <p>Automated systems may incorporate:</p> <ul style="list-style-type: none"> <li>mechanical, electronics, programming, electrical and fluid power elements in a system designed to achieve a desired output in response to a variety of inputs, disturbances and variables</li> </ul>
<p><b>Automated systems engineering techniques</b></p>	<p>Automated systems engineering techniques includes:</p> <ul style="list-style-type: none"> <li>the use of system analysis, mechanical and electro, programming and software skills for design, installation, commissioning, troubleshooting and maintenance of systems, processes and services</li> </ul> <p>Automated systems technique may be enhanced by:</p> <ul style="list-style-type: none"> <li>the development of basic capabilities with hand and power tools, experience of processes and materials properties</li> </ul>
<p><b>Automated systems applications</b></p>	<p>In general, principles and techniques for automated systems will include:</p> <ul style="list-style-type: none"> <li>mechanical, structural, hydraulic, pneumatic, fluid pumping, electrical and electronic control principles and techniques</li> </ul> <p>The control systems will typically include:</p> <ul style="list-style-type: none"> <li>sensory elements, such as position, level, pressure, temperature, flow rate, pH sensors, computer, PLC or dedicated microprocessor control together with appropriate signal conditioning and actuator interfacing. Emergency stop and failsafe design should be incorporated as required</li> </ul> <p>Communications may be:</p> <ul style="list-style-type: none"> <li>hard-wired, telemetric, radio or phone linked</li> </ul> <p>Specific avionic applications include:</p> <ul style="list-style-type: none"> <li>automatic flight control systems</li> <li>full authority digital engine control systems</li> <li>engine indicating and crew alerting systems</li> </ul>

	<ul style="list-style-type: none"><li>• flight management systems</li><li>• telemetry associated with flight test recording</li><li>• aircraft electronic instrument display systems</li><li>• electronic centralised aircraft monitor systems</li></ul>
<b>Sources of information</b>	Sources of information include: <ul style="list-style-type: none"><li>• reference texts</li><li>• relevant standards</li><li>• manufacturer catalogues and industrial magazines</li><li>• websites</li><li>• use of phone, email and fax information gathering</li></ul>
<b>Regulatory requirements</b>	Regulatory requirements may be found in: <ul style="list-style-type: none"><li>• Civil Aviation Regulations or Civil Aviation Safety Regulations</li><li>• Technical Airworthiness Maintenance Manual (AAP 7001.053)</li><li>• Federal Aviation Regulations (United States)</li><li>• European Aviation Safety Regulations</li><li>• Transport Canada CTA Rules</li></ul>

## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

# **MEM23109A Apply engineering mechanics principles**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the application of mechanics and strength of materials principles to devices, machines and systems and their components in order to identify key mechanical properties. It includes a range of basic analyses of static and dynamic loads and moments, stresses and deflections, velocities and accelerations.

## **Application of the Unit**

This unit applies to analysis of mechanical devices, machines and systems and their components to determine a range of mechanical related properties. It covers the analysis of 2-D forces and moments, stresses and deflections on bodies, frames and beams. It is suitable for people working as technicians in engineering or related fields using basic mechanics principles and those pursuing careers and qualifications in engineering or related disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Identify scope of required analysis                            | 1.1 | Identify device, machine or system and component parts for analysis  |
|   |  | 1.2 | Assess engineering mechanics principles, skills and techniques required by tasks   |
|   |  | 1.3 | Review functions and features of devices, machines and systems   |
|   |  | 1.4 | Assess software techniques required for basic analysis and graphics required by the task   |
|   |  | 1.5 | Identify stakeholders to be consulted on analysis tasks  |
|   |  | 1.6 | Confirm work health and safety (WHS) and regulatory requirements, risk management and organisational procedures  |
|   |  | 1.7 | Review sustainability implications of tasks  |
|   |  | 1.8 | Determine available sources for any required technical and professional assistance   |
| 2 | Apply engineering mechanics principles and techniques to tasks | 2.1 | Identify appropriate engineering mechanics principles and analytical, graphical and software-assisted techniques applicable to task  |
|   |  | 2.2 | Validate software results using analytical and graphical methods   |
|   |  | 2.3 | Ensure clear and logical process of analysis and compatibility of units in calculations  |
|   |  | 2.4 | Apply resultant loads and reactions on machines, support frames and beams due to parallel and oblique, concentrated and distributed loads and moments  |
|   |  | 2.5 | Apply the torque and power required to drive translation screws and winding drums against inclined and vertically suspended loads subject to gravitation, acceleration and friction resistance loads |

- |   |                |   |
|---|----------------|---|
|   | 2.6            | Select a range of standard hardware to meet specifications                                |
|   | 2.7            | Analyse bending and shear stresses in beams subject to static point and distributed loads |
| 3 | Report results | 3.1 Record results of investigation, evaluation and application                           |
|   |                | 3.2 Provide documentation, such as calculations, diagrams, programs and files             |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying parameters and context of tasks, chain of responsibility, WHS and regulatory requirements, risk management and organisational procedures
- confirming personal functions and responsibilities, team and support functional group interdependencies and communications, appropriate qualifications and delegations, and appropriate support
- reviewing sustainability implications, functions and features of devices, machines and systems
- assessing and applying mechanics principles, software basic analysis and graphics skills and techniques to mechanical devices and systems
- employing techniques to ensure clear and logical process of analysis and compatibility of units in calculations
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

### Required knowledge

Required knowledge includes:

- mathematical techniques, including arithmetic, algebra, trigonometry, geometry and differential calculus
- definition of typical applications of mechanics, statics, dynamics, kinematics, kinetics and strength of materials
- analytical, graphical, semi-graphical and software-assisted techniques for all tasks

- physical quantities and dimensions, including international system of units (SI) and fundamental dimensions and units
- basic principles of statics applicable to mechanical devices and systems
- application of force systems applied to bodies, frames and beams
- friction laws and applications in mechanical devices and systems
- stress and strain:
  - axial stress
  - shear stress
  - bolted and welded joints
  - torsional stress
- bending of beams
- dynamics applicable to mechanical devices and systems, including:
  - kinematics of rectilinear motion:
    - displacement, velocity and acceleration
    - equations of rectilinear motion
    - equations of simple harmonic motion
    - uniform acceleration and sinusoidal acceleration
  - kinetics of rectilinear motion:
    - force, mass and acceleration
    - freely falling bodies
    - acceleration against resistance (accelerating force = unbalanced force)
    - acceleration against gravity and terminal velocity
    - acceleration against dry sliding friction and air resistance
    - forces diagrams
  - curvilinear motion:
    - normal acceleration in curvilinear motion
    - centrifugal force
    - circular motion as a particular case of curvilinear motion
  - kinematics of rotation:
    - rotational motion
    - angular displacement
    - angular velocity
    - angular acceleration
    - conversions of units of angular motion
    - equations of rotation with uniform acceleration
    - relation between linear and angular motion
  - kinetics of rotation:
    - moment of inertia, second moment of mass, concept and units
    - torque due to inertia compared with torque due to winding drum rope force
- the law of a machine

- work, energy and power
- specifications for engineering hardware applicable to mechanical devices and systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply principles of mechanics to machines, support frames, beams and related components to determine static and dynamic loads, stresses and deformations to contribute to the design and component selection process.</p> <p>This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of tasks</li> <li>• apply WHS, regulatory requirements, risk management and organisational procedures</li> <li>• confirm personal functions and responsibilities</li> <li>• review sustainability implications, functions and features of devices, machines and systems</li> <li>• assess and apply engineering mechanics principles, including use of software basic analysis and graphics skills and techniques</li> <li>• ensure compatibility of units in calculations</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be</li> </ul>

	<p>made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering mechanics tasks</b>	<p>Engineering mechanics tasks covered by this unit include, but are not limited to:</p> <ul style="list-style-type: none"> <li>application of resultant loads and reactions on machines, support</li> </ul>
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	<p>frames and beams</p> <ul style="list-style-type: none"> <li>• application of the torque and power required to drive translation screws and winding drums against inclined and vertically suspended loads subject to gravitation, acceleration and friction resistance loads</li> <li>• selecting a range of standard hardware, such as shafts, bolts and hooks, subject to plane axial or shear stresses and deformation limits</li> <li>• analysing bending and shear stresses in beams subject to static point and distributed loads</li> </ul>
<b>Motion</b>	Motions described in this unit may be of constant velocity, constant acceleration or sinusoidal accelerations (e.g. sprung bodies). Other non-uniformly accelerated motions may be described for contrast only. This unit confines itself to 2-D plane motion
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies may include: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>

<b>Analysis</b>	Analysis may include: <ul style="list-style-type: none"><li>• static and dynamic analysis of loads</li><li>• the stresses and deformations resulting</li><li>• the transmitted power, torque and speed</li><li>• graphical and mathematical methods and software options</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23111A Select electrical equipment and components for engineering applications**

## **Modification History**

Release 1 - New unit. Replaces MEM23051A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the identification and matching of electrical supply and electrical system equipment and components to mechanical, manufacturing and mechatronic engineering applications. It includes electrical principles and laws, inductive and capacitive effects on AC supplies, control system power supply fundamentals, electrical safety and earthing systems, electrical motors and motor controls.

## **Application of the Unit**

This unit applies to people working as technicians in engineering or related fields where electrical power supply, equipment and systems must be considered. The unit applies to mechanical, manufacturing and mechatronic engineering applications which include electrical equipment, including domestic, commercial or industrial situations. Electrical equipment and component identification covered by this unit is from manufacturer catalogues or other standard specifications. The unit does not cover one-off design or modification to electrical equipment.

The unit does not cover the undertaking of licensed electrical work but will often apply to individuals working as part of a team that includes licensed electricians.

This unit includes knowledge of electrical dangers and safety procedures and the need to comply with work health and safety (WHS) and electrical regulatory requirements.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Investigate context of electrical equipment and supply                                       | 1.1 | Review functions and features of devices  |
|   |  | 1.2 | Identify safe machine   |
|   |  | 1.3 | Identify WHS and regulatory requirements  |
|   |  | 1.4 | Determine available sources for any required licensed electrical  |
|   |  | 1.5 | Review sustainability implications of energy source options   |
| 2 | Determine electrical supply, equipment and components required for engineering-related tasks | 2.1 | Assess electrical supply specifications for engineering application   |
|   |  | 2.2 | Analyse electrical motors and their control options for suitability   |
|   |  | 2.3 | Estimate power factor requirements for engineering applications   |
|   |  | 2.4 | Examine engineering application control and communication requirements                                      |
|   |  | 2.5 | Appraise isolation, shutdown and emergency equipment options  |
|   |  | 2.6 | Analyse maintenance, life cycle and sustainability requirements of electrical systems and equipment options |

- |   |                |   |
|---|----------------|---|
|   | 2.7            | Apply specification, documentation and graphical techniques, modelling, mock-up or prototyping techniques, where required, to achieve or test options |
|   | 2.8            | Identify preferred electrical supply system, equipment and components   |
| 3 | Report results |   |
|   | 3.1            | Record results of investigation, evaluation and application   |
|   | 3.2            | Provide documentation, such as calculations, diagrams, programs and files   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- evaluating relevance of WHS, regulatory requirements, standards and codes of practice
- evaluating multiple solutions against design criteria, risk, sustainability and cost factors
- applying life cycle design and sustainability parameters to identification of task
- solving problems and making decisions with systems thinking approach for contingencies and constraints and continuous improvement
- reviewing sustainability implications, functions and features of devices, machines and systems employing electricity and electrical principles
- integrating electrical evaluation techniques with overall engineering application requirements, including mechanical; fluid power; electronic; heating, ventilation, air conditioning and refrigeration (HVAC/R); and controller and networking
- assessing and applying basic electrical principles and techniques, software basic analysis and graphics skills and techniques to engineering tasks
- ensuring safe electrical working practice
- ensuring compatibility of units in calculations
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

### Required knowledge

Required knowledge includes:

- energy source options, sustainability implications of electricity generation, distribution and use
- sustainable sources of energy
- features and function of electrical systems in a range of engineering applications, such as:
  - sources and reliability of supply (e.g. mains, generators and batteries)
  - fault and other protection requirements
  - electrical system control and interfacing with other systems
  - maintainability
  - efficiency
  - fitness for purpose
- WHS and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and registration requirements
- the effects of electricity on humans, including dangerous high currents and voltages related to extra low, low and high voltage applications and relating these to engineering applications
- licensed technical and professional assistance
- electrical laws and theorems
- electrical circuit components
- AC and DC electrical supply systems:
  - single and 3-phase power
  - power factor
  - distribution systems, including transformers, cables and switchboards
  - local area distribution considerations and supply authority requirements
  - typical and possible faults and dangerous situations
  - earthing systems, such as multiple earth neutral (MEN) system
- circuit protection devices, such as fuses, thermal relays, circuit breakers and residual current devices
- basic electrical circuits and applications for lighting, motors, controllers, heaters and coolers
- graphical symbols and diagrammatic representation of basic circuits and power supply fundamentals
- electrical power consumption
- electrical measurements and techniques

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must
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	<p>be able to apply electrical principles to ensure safe practice, assist with systems development, component selection and maintenance and broadly evaluate electrical features, functions and performance of machines or systems.</p> <p>This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify effects and dangers of electricity</li> <li>• review sustainability implications, functions and features of electrical devices, machines and systems</li> <li>• assess and apply basic electrical principles and techniques</li> <li>• evaluate of suitability of electric power supply for applications</li> <li>• apply appropriate calculations and methods for electric motor control</li> <li>• ensure safe electrical working practice and compatibility of units in calculations</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application</li> </ul>

	<p>of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Electrically powered equipment and systems</b>	<p>Electrically powered equipment and systems in mechanical, manufacturing and mechatronic engineering applications may include:</p> <ul style="list-style-type: none"> <li>• motors</li> <li>• electrical supply equipment, including transformers, switchboards, and power circuit components</li> <li>• sensors, programmable logic controllers (PLCs) and control circuits</li> <li>• isolation, shutdown and emergency cut-offs</li> <li>• lighting</li> <li>• heating, cooling and ventilation</li> <li>• average and maximum load, power factor, switch board layout, earthing and protection systems and power consumption and cost</li> </ul>
• <b>Electrical-related engineering tasks</b>	Electrical-related engineering tasks covered by this unit include, but



	<p>are not limited to:</p> <ul style="list-style-type: none"> <li>• determining WHS, regulatory and risk management requirements</li> <li>• evaluating electrical supply options</li> <li>• technical evaluation of options for electrical equipment and components against performance, cost and reliability requirements</li> <li>• determining methods for start, stop, speed control and reversing of a range of electric motors</li> <li>• matching of electrical equipment to other systems</li> </ul>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and programmable electronic control systems'</p>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements applying to electrical work</li> </ul>

<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular mechatronic analysis task
<b>Systems thinking</b>	Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Life cycle assessment</b>	Life cycle analysis can be used to improve sustainability of products and services. It may be applied to: <ul style="list-style-type: none"><li>• all aspects of manufacture of a single product</li><li>• the entire operations of an organisation</li><li>• a particular aspect of operations, such as environmental implications</li></ul>
<b>Sustainability implications</b>	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# **MEM23112A Investigate electrical and electronic controllers in engineering applications**

## **Modification History**

Release 1 - New unit. Replaces MEM23051A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers investigation of new or existing controllers for suitability in automated systems used in engineering applications. The unit includes the application of fundamental controller programming techniques and control system power supply requirements, basic programmable logic controller (PLC), microcontroller and system control and data acquisition (SCADA) applications.

## **Application of the Unit**

The unit applies to controllers used in automated systems in industry. Typical applications of the unit include assessing the ongoing suitability of existing controllers, programming of PLCs, adjustments to controllers for new equipment or products, and condition monitoring.

It is suitable for people working as automation or mechatronics technicians and for people using the services of electrical and control systems technicians. It is suitable for those pursuing careers and qualifications in mechatronic or automated system design and maintenance.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Determine scope of electro and controller operation            | 1.1 | Assess current or proposed controller context for electrical and automation safety and risks   |
|   |  | 1.2 | Identify potential or actual dangerous high currents and voltages and check for regulatory compliance requirements related to extra low, low and high voltage applications                   |
|   |  | 1.3 | Identify work health and safety (WHS) and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and organisational procedures |
|   |  | 1.4 | Identify stakeholders to be consulted on investigation task  |
|   |  | 1.5 | Investigate software and software techniques required for basic analysis and graphics required for controller investigation task   |
|   |  | 1.6 | Ensure appropriate support, including licensed electrical, technical and professional assistance is available  |
| 2 | Review functions and features needed in controller application | 2.1 | Use analytical and graphical software, as required, to review controller application and function  |
|   |  | 2.2 | Validate software results  |
|   |  | 2.3 | Undertake instrument readings, as required   |

3	Program controllers and SCADA applications for required functions	3.1	Program controller as required for required sequencing and actuations for applications
		3.2	Develop simple SCADA applications for required interactions with inputs and outputs of controllers
4	Report results	4.1	Record outcomes of investigation, evaluation and application
		4.2	Provide documentation, such as calculations, diagrams, programs and files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying parameters and context of tasks, WHS, regulatory requirements, risk management and organisational procedures
- reviewing effects of electricity on humans, dangerous high currents and voltages and automated systems, regulatory requirements related to extra low, low and high voltage applications, and relating these to electrical and electronic applications in engineering
- reviewing sustainability implications of functions and features of devices, machines, controllers, interfaces, signal conditioning and networks programming and interfacing of PLCs, including sequencing two or more actuations with start, stop and actuation motion confirmation signals
- ensuring safe electrical working practice, including use of licensed personnel
- describing information flow and control as a flowchart
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

### Required knowledge

Required knowledge includes:

- the effects of electricity on humans
- electrical laws:
  - Ohm's law
  - Kirchhoff's voltage and current laws

- analogies with hydraulics, pressure drop and continuity
- automated systems and mechatronic devices (Note: This unit does not include design or modification of interfacing with these devices)
- common software requirements of control systems, including SCADA, distributed control systems (DCS) and programming
- PLC and microcontroller basic programming functions
- SCADA, including basic editing and programming techniques
- documentation techniques, circuit diagrams, programs and applications
- specifications for hardware applicable to controller techniques in engineering

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply controller principles to ensure safe practice, assist with systems development, component selection and maintenance and broadly evaluate electrical, electronic and controller features and functions.</p> <p>This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• identify and apply WHS, regulatory and risk management procedures</li><li>• review dangers and effects of electricity on humans</li><li>• identify effects and dangers of electricity, automated systems and specialist requirements, such as licensing related to technical work</li><li>• confirm personal functions and responsibilities and that of team and support functional group</li><li>• review sustainability implications, functions and features of controllers and related devices, machines and systems</li><li>• assess and apply basic electrical and electronic control principles, controller programming principles and techniques to simple machine control functions</li><li>• ensure safe electrical working practice</li></ul>

	<ul style="list-style-type: none"> <li>• ensure clear and logical process of analysis</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>



## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Controllers</b>	<p>Controllers may be:</p> <ul style="list-style-type: none"> <li>• PLCs</li> <li>• microcontrollers</li> <li>• DCS</li> <li>• SCADA</li> <li>• other systems and equipment, including proprietary equipment</li> </ul>
<b>Controller tasks</b>	<p>Controller tasks covered by this unit include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• determining WHS, regulatory, risk management and automation safety requirements</li> <li>• programming and interfacing a PLC capable of sequencing two or more actuations with start, stop and actuation motion confirmation signals</li> <li>• developing a simple SCADA application capable of interacting with inputs and outputs of PLCs and/or microcontrollers</li> </ul>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity</p>
<b>Appropriate licensed trade, technical and professional assistance</b>	<p>Appropriate licensed trade, technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• availability of licensed electrical tradespersons for work covered by electrical licensing regulations</li> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies may include: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory</b>	<p>WHS, regulatory requirements and enterprise procedures may</p>

<b>requirements and enterprise procedures</b>	<p>include:</p> <ul style="list-style-type: none"><li>• WHS Acts and regulations</li><li>• relevant standards</li><li>• codes of practice from Australian and overseas engineering and technical associations and societies</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• state and territory regulatory requirements applying to electrical work</li></ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task</p>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23113A Evaluate hydrodynamic systems and system components**

## **Modification History**

Release 1 - New unit. Replaces MEM23081A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the evaluation of fluid systems and system components. It includes hydrodynamic fundamentals, including properties of fluids and system component materials, evaluation of system component performance related to flow rates, pressures, forces and power of containment, transport and use of fluids, work health and safety (WHS) compliance requirements and risk management procedures.

## **Application of the Unit**

This unit applies to evaluation of fluid systems and components used in hydrodynamic systems. It is suitable for people working as technicians in these industries or system designers, draftspersons and maintainers, and those pursuing careers and qualifications in engineering or related disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish scope of hydrodynamic system	1.1	Determine fluid systems and system components to be evaluated
		1.2	Identify stakeholders to be consulted on evaluation tasks
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Determine WHS and regulatory requirements, risk management and organisational procedures
		1.5	Investigate sustainability implications of hydrodynamic applications
2	Apply principles and techniques required for evaluation of hydrodynamic system and components	2.1	Review features and functions of hydrodynamic system and components
		2.2	Determine hydrodynamic principles and techniques required to evaluate system and select and optimise components
		2.3	Determine appropriate analysis techniques, software and software validation techniques
3	Evaluate hydrodynamic system and components	3.1	Assess components and system compatibility with fluid properties
		3.2	Assess suitability of pumps and pump performance in hydrodynamic system
		3.3	Assess forces on bends and section changes in piping systems and confirm they are within specification
		3.4	Assess hydrodynamic performance of components, such as fittings, valves and hoses

		3.5	Assess open channel systems and optimise for required flow rates
		3.6	Evaluate collar and cylindrical bearings subject to boundary, transitional and hydrodynamic lubrication
4	Report results	4.1	Record outcomes of evaluation
		4.2	Provide documentation, such as calculations, component and system layouts, and functional diagrams

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining parameters and context of tasks
- identifying WHS and regulatory requirements
- identifying risk management and organisational procedures
- reviewing sustainability implications, features and functions of hydrodynamic systems and components
- identifying hydrodynamic principles and techniques, analysis techniques, software and software validation techniques
- ensuring compatibility of units in calculations
- evaluating components and system compatibility with fluid properties, pumps, turbines, piping forces, hydrodynamic performance of components, open channel systems, collar and cylindrical bearing lubrication
- selecting equipment and instruments for use in evaluation considering properties and compatibility
- reporting and documenting results of scoping, principles and techniques identification, evaluation of applications, calculations, component and system layouts, and functional diagrams

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements

- availability of professional and technical assistance for engineering specialisations
- current options and trends in performance analysis software, including underpinning program techniques and software validation techniques
- properties of fluids:
  - fluid types
  - relevant units of measurement
  - chemical properties
- sustainability issues:
  - hydrodynamic energy, generation and consumption
  - environmental effects of manufacturing and use
- fluid statics
- fluid dynamics, including:
  - flow
  - velocity
  - viscosity
  - pressure
  - fluid power
  - hydrodynamic forces
- hydrodynamic system components
- head loss in pipes and fittings
- pumping systems, including components and methods for determining efficiency
- forces developed by flowing fluids
- open channel flow
- oiled bearings

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate hydrodynamic systems, including evaluation of system performance, selection of components and calculation of fluid force.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• determine parameters and context of evaluation task</li><li>• determine WHS, regulatory requirements, risk management and organisational procedures</li></ul>

	<ul style="list-style-type: none"> <li>• identify features, functions and components of a range of hydrodynamic systems</li> <li>• investigate and review sustainability implications, features and functions of hydrodynamic systems and components</li> <li>• apply correct hydrodynamic principles and techniques for particular hydrodynamic systems</li> <li>• evaluate components and systems to determine safety, efficiency and fitness for purpose</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Hydrodynamic systems</b>	<p>Hydrodynamic systems include:</p> <ul style="list-style-type: none"> <li>• fluid vessels (e.g. static dams, tanks and pools, and vessel in dynamic applications)</li> <li>• pumping systems (e.g. industrial wash, fire prevention and irrigation)</li> <li>• turbines for hydro-electric power generation</li> <li>• components, such as fluid containers, ducts, pipes, valves, pumps, turbines and fluid measuring devices</li> <li>• open channels for liquid transfer</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low</li> </ul> </li> </ul>



	<p>voltage</p> <ul style="list-style-type: none"><li>• professional support for technologies, such as:<ul style="list-style-type: none"><li>• specialist electric motor drives and controllers</li><li>• specialist materials, plastics, metal alloys and nano materials</li><li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li></ul></li></ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"><li>• WHS Acts and regulations</li><li>• relevant standards</li><li>• codes of practice from Australian and overseas engineering and technical associations and societies</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• state and territory regulatory requirements applying to electrical work</li></ul>
<b>Standards and codes</b>	<p>Standards and codes refers to all relevant Australian and international standards and codes applicable to a particular hydrodynamic system task</p>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# MEM23114A Evaluate thermodynamic systems and components

## Modification History

Release 1 - New unit. Replaces MEM23081A, but not equivalent.

## Unit Descriptor

This unit of competency covers the evaluation of thermodynamic systems and components, such as heat exchangers, heat engines, refrigeration and air conditioners, and air compressors.

## Application of the Unit

This unit applies to the evaluation of thermodynamic systems and components. The evaluation may be undertaken as part of a design or system selection process or to assess system condition, sustainability or efficiency. It is suitable for people working as technicians or system designers and draftspersons, and those pursuing careers and qualifications in engineering or related disciplines.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of thermodynamic system	1.1	Determine thermodynamic system and system components to be evaluated
		1.2	Determine stakeholders to be consulted on the evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Determine work health and safety (WHS) and regulatory requirements, risk management and organisational procedures
		1.5	Investigate sustainability implications of thermodynamic applications
2	Identify principles and techniques required for evaluation of thermodynamic system and components	2.1	Review features and functions of thermodynamic system and components
		2.2	Determine thermodynamic principles and techniques required to evaluate system and select and optimise components
		2.3	Determine appropriate analysis techniques, software and software validation techniques
3	Evaluate thermodynamic applications and components	3.1	Assess the performance of heat transfer devices
		3.2	Assess heat engine performance
		3.3	Assess combustion processes
		3.4	Assess steam processes, where present
		3.5	Assess refrigeration and air conditioning processes, where present
		3.6	Assess air compression processes, where present
4	Report results	4.1	Record outcomes of evaluation

- 4.2 Provide documentation, such as calculations, component and system layouts, and functional and thermodynamic cycle diagrams

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining parameters and context of tasks
- identifying WHS and regulatory requirements
- identifying risk management and organisational procedures
- investigating and reviewing sustainability implications, features and functions of thermodynamic systems and components
- identifying thermodynamic principles and techniques, analysis techniques, software and software validation techniques
- evaluating components, combustion, steam, air compression, refrigeration and air conditioning processes
- system compatibility with fluid properties, pumps, turbines, piping forces and thermodynamic performance of components
- selecting equipment and instruments for use in evaluation considering properties and compatibility
- reporting and documenting results of scoping, principles and techniques identification, evaluation of applications, calculations, component and system layouts, and functional diagrams and thermodynamic cycle diagrams

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards and risk management requirements
- availability of professional and technical assistance
- current options and trends in performance analysis software, including underpinning program techniques and software validation techniques
- descriptions of thermodynamic devices and systems, such as boilers, turbines, refrigerators, gas-turbines and rockets
- concepts related to thermodynamics, such as:
  - properties, process and state

- mass, conservation of mass, specific volume and density, force, weight, pressure and temperature
- systems, cycles and steady state
- energy forms
- effects of heating of solids and liquids
- heat transfer, conduction, convection and radiation, including related laws and calculations
- typical thermodynamic devices and engines, and thermal cycles
- closed and open systems:
  - non-flow, internal energy
  - flow systems, mass and volumetric flow and continuity of flow
- steady flow and enthalpy, turbines, compressors, boilers and heat exchanger applications
- zeroth and first laws in detail and second law (conceptual)
- gas laws and characteristics
- gas compression effects, measurements and calculations
- compressor types and characteristics heat engines, including types, cycles, performance and efficiency fuels and combustion steam plant and processes for steam generation, heat transfer and power production, including:
  - steam saturation steam tables
- air conditioning, refrigeration and heat pumping plant and processes

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate thermodynamic systems, including evaluation of system performance and selection of components.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of evaluation task</li> <li>• determine WHS, regulatory requirements, risk management and organisational procedures</li> <li>• identify features, functions and components of a range of thermodynamic dynamic systems and components</li> <li>• investigate and review sustainability implications, features and functions of thermodynamic systems and components</li> </ul>

	<ul style="list-style-type: none"> <li>• evaluate components and systems to determine safety, efficiency and fitness for purpose</li> <li>• evaluate combustion, steam, air compression and refrigeration and air conditioning processes</li> <li>• determine system performance and heat transfer</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• ministerial directives</li> </ul>

	<ul style="list-style-type: none"><li>• risk assessments</li><li>• safe work practices</li><li>• state and territory regulatory requirements applying to electrical work</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular thermodynamic system task

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.



## **MEM23115A Evaluate fluid power systems**

### **Modification History**

Release 1 - New unit. Replaces MEM23081A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the evaluation of hydraulic and pneumatic systems and components, including automated fluid power applications characterised by two or three actuators requiring digital control of valves and preset flow and pressure control.

### **Application of the Unit**

This unit applies to the evaluation of manual and automated fluid power systems and components. The evaluation may be undertaken as part of a design or system selection process or to assess system condition, sustainability or efficiency.

It is suitable for people working as fluid power technicians or system designers, draftspersons and maintainers, and those pursuing careers and qualifications in engineering or related disciplines.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of fluid power system evaluation	1.1	Determine fluid power systems and components to be evaluated
		1.2	Identify stakeholders to be consulted on the evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Determine relevant work health and safety (WHS) and regulatory requirements, risk management and organisational procedures
		1.5	Investigate sustainability implications of fluid power applications
2	Identify principles and techniques required for evaluation of fluid power systems and components	2.1	Review features and functions of pneumatic systems and components for relevance to evaluation
		2.2	Review features and functions of hydraulic systems and components for relevance to evaluation
		2.3	Determine fluid power principles and techniques required to evaluate systems and select and optimise components
		2.4	Determine appropriate analysis techniques, software and software validation techniques
3	Evaluate fluid power systems and components	3.1	Assess fluid suitability, compatibility, and treatment relative to systems
		3.2	Assess features, functions and suitability of hydraulic systems and components for applications
		3.3	Assess features, functions and suitability of pneumatic

- components for applications
- 3.4 Assess suitability of fluid power system and components in automated power applications using two or three actuator hydraulic or pneumatic circuits with digital fluid and electrical/electronic control elements
- 4 Report results
- 4.1 Record outcomes of evaluation
- 4.2 Provide documentation, such as calculations, component and system layouts, and functional diagrams and fluid power process, and control signal diagrams

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining parameters and context of fluid power systems
- identifying WHS and regulatory requirements
- identifying risk management and organisational procedures
- investigating and reviewing sustainability implications, features and functions of fluid power systems and components
- identifying fluid power principles and techniques, analysis techniques, including use of software and software validation techniques
- evaluating fluid suitability, compatibility and treatment, features and functions of hydraulic and pneumatic components and systems both automated and non-automated, digital fluid and electrical/electronic control elements
- reporting and documenting results of scoping, principles and techniques identification, evaluation of applications, calculations, component and system layouts, functional diagrams and fluid power process and control signal diagrams

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards, risk management requirements
- availability of professional and technical assistance

- current options and trends in performance analysis software, including underpinning program techniques and software validation techniques
- common applications for pneumatics and hydraulics
- comparative advantages of fluid power over mechanical and electrical power for particular applications
- characteristics and properties of pneumatic and hydraulic fluids and relative compressibility of air and hydraulic fluid
- applications and selection criteria for mineral, synthetic and fire-resistant fluids and compatibility of fluids with system materials
- fluid power fundamental principles and calculations for system components, including:
  - conservation of energy
  - energy measurement and units
  - energy forms
  - hydraulics fundamentals, such as pressure, temperature and flow rate relative to actuator force
  - pneumatic fundamentals, such as gas laws, pressure difference and flow rate, and flow to atmosphere
- features and functions and selection criteria of fluid power components in applications, including:
  - pumps
  - valves electrical circuits and control elements actuators
  - accumulators
  - compressors (pneumatics)
  - reservoirs
  - gauges and instrumentation
  - hoses, pipes, filters and fittings
- types and requirements for fluid and electrical circuits maintenance requirements for fluid power systems
- methods of circuit presentation, standard symbols, circuit sequence and signal condition diagrams for multi-actuator circuits

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate fluid power systems both automatic and non-automated for safety, economy and fitness for purpose, including selection of components.
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<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of evaluation task</li> <li>• determine WHS and regulatory requirements, risk management and organisational procedures</li> <li>• investigate and review sustainability implications, features and functions of fluid power systems and components</li> <li>• identify fluid power principles and techniques analysis techniques, software and software validation techniques</li> <li>• evaluate fluid suitability, compatibility and treatment, features and functions of hydraulic and pneumatic components and systems, digital fluid and electrical/electronic control elements</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of</li> </ul>

	<p>process.</p> <ul style="list-style-type: none"> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Hydraulic applications</b>	<p>Hydraulic applications may include:</p> <ul style="list-style-type: none"> <li>• mobile vehicles and plant</li> <li>• equipment for moving and positioning heavy loads</li> <li>• industrial machinery (e.g. presses for punching, drawing and forging)</li> <li>• industrial and mobile braking systems</li> </ul>
<b>Pneumatic applications</b>	<p>Pneumatic applications may include:</p> <ul style="list-style-type: none"> <li>• transfer mechanisms for moving and positioning light loads</li> <li>• medium load clamping and stamping operations</li> <li>• compressed air distributed systems</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>

<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular fluid power system task</p>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.





# **MEM23116A Evaluate programmable logic controller and related control system component applications**

## **Modification History**

Release 1 - New unit. Replaces MEM23082A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the evaluation of automated devices, machines and processes controlled by programmable logic controllers (PLCs). It includes basic PLC architecture, associated control system components and programming techniques, work health and safety (WHS) compliance requirements, risk management, automation safety, networking for data sharing and remote control, and broad implications of wiring rules.

## **Application of the Unit**

This unit applies to evaluations of PLCs and their use in engineering applications. The evaluation may be undertaken as part of a PLC selection process or to assess PLC and control system condition or efficiency. It is suitable for people working as automation, mechatronics or maintenance technicians or for those pursuing qualifications or careers in those disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A Apply technical mathematics

MEM23111A Select electrical equipment and components for engineering applications

MEM23112A Investigate electrical and electronic controllers in engineering applications

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Determine scope of evaluation                   | 1.1 | Confirm and apply safe electrical working practice   |
|   |   | 1.2 | Review the currents and voltages present in the PLC applications and check for regulatory requirements and dangerous high currents and voltages, including effects on humans and on application equipment and components |
|   |   | 1.3 | Identify WHS and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and organisational procedures  |
|   |   | 1.4 | Determine requirement for PLC and related control system components  |
|   |   | 1.5 | Ensure appropriate support, including licensed electrical, technical and professional assistance, is available.  |
|   |   | 1.6 | Determine software and software techniques for analysis and graphics required by the evaluation task   |
|   |   | 1.7 | Identify stakeholders to be consulted on evaluation  |
|   |   | 1.8 | Investigate sustainability implications of PLC applications  |
| 2 | Establish existing features of PLC applications | 2.1 | Review the functions and features of devices, machines and processes controlled by PLCs  |
|   |   | 2.2 | Identify features and functions of PLC systems and components  |
|   |   | 2.3 | Review PLC programming and functions   |
|   |   | 2.4 | Identify system integrating principles and techniques, signal conditioning and power interfacing   |

- |   |                           |     |   |
|---|---------------------------|-----|---|
|   |                           | 2.5 | Identify networking and system supervision, data acquisition and systems control options  |
| 3 | Evaluate PLC applications | 3.1 | Determine suitability of components of application including sensor/transducers, PLC and output devices, signal conditioning and interfacing  |
|   |                           | 3.2 | Establish suitability of controller functions, PLC software and programming   |
|   |                           | 3.3 | Determine suitability of network, system control and data acquisition (SCADA) communications protocols, standards and network topologies, human-machine interfaces (HMIs) and graphical user interfaces (GUIs) used by applications |
|   |                           | 3.4 | Evaluate compliance of application with WHS and regulatory requirements, codes of practice, standards and risk management procedures  |
| 4 | Report results            | 4.1 | Record results of evaluation  |
|   |                           | 4.2 | Provide documentation, such as layouts, programs, flow charts, state diagrams and files   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying features and functions of PLCs and control systems, including:
  - components
  - signal conditioning and power interfacing
  - networking and system supervision, data acquisition and systems control options
- ensuring safe electrical working practice, including use of licensed personnel, where required
- investigating sustainability implications of PLC applications
- evaluating safety, condition, efficiency and functionality of PLCs and associated applications, including:

- controller functions and programming
- network and interfacing, including SCADA, communications protocols, standards and network topologies
- suitability of HMIs and GUIs
- compliance with WHS and regulatory requirements
- applying WHS, regulatory and automation safety requirements, risk management and organisational procedures
- reporting and documenting results of evaluation, including layouts, programs, flow charts or state diagrams and files

## Required knowledge

Required knowledge includes:

- features of a range of PLC and related control system component applications used in engineering environments
- effects of electricity on humans, dangerous high currents and voltages and automated systems, regulatory requirements related to extra low, low and high voltage applications
- relevant compliance requirements of WHS, regulations, codes of practice, standards, and risk assessment requirements for integrated manufacturing systems with particular emphasis on automation safety
- hardware functions, options and integration into PLC and related control systems
- input devices/sensors
- output devices/actuators
- PLCs
- interfacing and signal conditioning
- communications and networking options for devices
- HMIs and GUIs
- PLC architecture
- Input/Output (I/O) functions and arrangements
- typical input signals and sensor/transducers
- shielding and twisted pairing for noise mitigation
- calibration techniques
- reading of discrete levels from analog input data (other analog I/O functions not required by this unit)
- input signal conditioning
- digitally driven output devices and interface requirements power supply
- programming techniques and options

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate PLCs and related control system component applications for safety, efficiency and function.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• identify and assess compliance with WHS and regulatory requirements, and risk management procedures</li><li>• review dangers and effects of electricity on humans</li><li>• identify PLC related systems and components, integrating principles and techniques</li><li>• assess suitability of programming</li><li>• investigate sustainability implications of PLC applications</li><li>• assess and apply basic electrical and electronic, control principles, controller programming principles and techniques, software basic analysis and graphics skills and techniques</li><li>• evaluate components of applications against application specifications for safety, economy and fitness for purpose</li><li>• report and document results.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li><li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li></ul>

	<ul style="list-style-type: none"> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>PLC applications</b>	<p>PLC applications may include:</p> <ul style="list-style-type: none"> <li>industrial (e.g. motor controllers, fault detectors and power controllers)</li> <li>multi-axis machine control</li> <li>process automation</li> <li>packaging, shrink-wrapping, labelling and palletising</li> <li>utilities, water treatment and effluent treatment</li> <li>industrial distributed control system</li> <li>amusement rides</li> <li>agricultural machine and irrigation controllers</li> <li>military and aerospace automation (except aircraft systems)</li> <li>mineral and chemical, and petroleum processing</li> </ul>
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<b>PLC software</b>	<p>PLC software and programming language may cover:</p> <ul style="list-style-type: none"> <li>• ladder diagram (LD) – graphical</li> <li>• function block diagram (FBD) – graphical</li> <li>• structured text (ST) – textual</li> <li>• instruction list (IL) – textual</li> <li>• sequential function chart (SFC) – elements to organise programs for sequential and parallel control processing</li> </ul> <p>PLC programming language standards may comply with IEC 61131-3 or other standards</p>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies may include: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular PLC related task</p>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, system interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and</p>

	programmable electronic control systems'
<b>Data and communications protocols and standards</b>	<p>Data and communications protocols and current standards may include:</p> <ul style="list-style-type: none"> <li>layered communications and networking protocols, such as Open Systems Interconnection Model (OSI Model) – 7 layers</li> <li>TCP/IP Internet Protocol Suite {Transmission Control Protocol (TCP) and the Internet Protocol (IP)} – 4 or 5 layers</li> <li>IEEE 802 Wireless PAN, LAN, MAN and WPAN standards</li> <li>interface standards, such as RS232 and RS485, Fieldbus, Modbus and DNP3.0</li> </ul>
<b>Network topologies</b>	<p>Network topologies may include:</p> <ul style="list-style-type: none"> <li>daisy-chain, star, ring, branch, linear and tree</li> <li>wired and wireless options</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>meeting all regulatory requirements</li> <li>conforming to all industry covenants, protocols and best practice guides</li> <li>minimising ecological and environmental footprint of process, plant and product</li> <li>maximising economic benefit of process plant and product to the organisation and the community</li> <li>minimising the negative WHS impact on employees, community and customer</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.



# MEM23117A Evaluate microcontroller applications

## Modification History

Release 1 - New unit. Replaces MEM23082A, but not equivalent.

## Unit Descriptor

This unit of competency covers the evaluation of automated devices, machines and processes controlled by microprocessors. This includes integration of input devices/sensors, output devices/actuators, controllers, interfacing and signal conditioning, human-machine interfaces (HMIs), networking options, data and communications protocols software, and programming of microcontrollers and automation safety. Analog interfacing is included but not proportional integral derivative (PID) interfacing.

## Application of the Unit

This unit applies to the evaluation of microcontrollers and their use in automated devices, machines and engineering processes. It is suitable for people working as automation, mechatronics or maintenance technicians or for those pursuing qualifications or careers in those disciplines.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Determine scope of evaluation                              | 1.1 | Confirm and apply safe electrical working practice   |
|   |  | 1.2 | Review the currents and voltages present in the microcontroller applications and check for regulatory requirements and dangerous high currents and voltages, including effects on humans and on application equipment and components |
|   |  | 1.3 | Identify work health and safety (WHS) and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and organisational procedures   |
|   |  | 1.4 | Identify software techniques and graphics required for evaluation  |
|   |  | 1.5 | Identify stakeholders to be consulted on evaluation tasks  |
|   |  | 1.6 | Identify sources of technical and professional assistance  |
|   |  | 1.7 | Investigate sustainability implications of microcontroller applications  |
| 2 | Establish existing features of microprocessor applications | 2.1 | Review the functions and features of devices, machines and processes controlled by microprocessors   |
|   |  | 2.2 | Identify features and functions of microprocessor devices and components   |
|   |  | 2.3 | Review microprocessor programming and functions  |
|   |  | 2.4 | Identify system integrating principles and techniques, signal conditioning and power interfacing   |

		2.5	Identify networking and system supervision, data acquisition and systems control options
3	Evaluate microcontroller applications	3.1	Determine suitability of components of application, including sensor/transducers, microcontroller and output devices, signal conditioning and interfacing used by applications
		3.2	Assess scope and suitability of microcontroller functions, software and programming to applications
		3.3	Assess suitability of network, system control and data acquisition (SCADA) options, communications protocols, standards and network topologies, HMIs and graphical user interfaces (GUIs) used by applications
		3.4	Review application for compliance with WHS and regulatory requirements, codes of practice, standards and risk management procedures
4	Report results	4.1	Record results of scoping, principles and techniques identification, and evaluation of applications
		4.2	Provide documentation, such as layouts, programs, flow charts, state diagrams and files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying features and functions of microcontroller systems, including:
  - components
  - system integrating principles and techniques
  - signal conditioning and power interfacing
  - networking and system supervision, data acquisition and systems control options
- ensuring safe electrical working practice, including use of licensed personnel
- investigating sustainability implications of microcontroller applications

- evaluating safety, condition, efficiency and functionality of microcontrollers and their applications, including
- components of applications
- controller functions and programming, network, SCADA, communications protocols, standards and network topologies
- HMIs and GUIs
- compliance with WHS and regulatory requirements
- applying WHS, regulatory and automation safety requirements, risk management and organisational procedures
- reporting and documenting results of scoping, principles and techniques identification, and evaluation of applications, layouts, programs and flow charts or state diagrams

## Required knowledge

Required knowledge includes:

- features of a range of microcontrollers and related control system component applications used in engineering environments
- compliance requirements of WHS, regulations, codes of practice, standards and risk assessment
- effects of electricity on humans, dangerous high currents and voltages and automated systems, and regulatory requirements related to extra low, low and high voltage applications
- hardware functions, options and integration with microprocessor applications
- input devices/sensors, output devices/actuators, controller, interfacing and signal conditioning, communications, HMIs, GUIs, and networking options for devices
- appropriate use of microprocessor related terminology
- microcontroller features and function, including:
  - volatile and non-volatile memory and data storage
  - one-time programmable and reprogrammable microcontrollers
  - typical microcontroller architecture characteristics
  - central processing unit (CPU) functions
  - interrupt structures
  - Input/Output (I/O) functions
  - timers and clocks
  - logic
  - programming methods and techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate microprocessor devices, machines and processes for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify and assess compliance with WHS and regulatory requirements, and risk management procedures</li> <li>• review dangers and effects of electricity on humans</li> <li>• identify microprocessor related systems and components, integrating principles and techniques</li> <li>• assess suitability of programming</li> <li>• investigate sustainability implications of microprocessor related applications</li> <li>• assess and apply basic electrical and electronic, control principles, controller programming principles and techniques, software basic analysis, and graphics skills and techniques</li> <li>• evaluate components of applications against application specifications for safety, economy and fitness for purpose</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Microcontroller</b>	Microcontrollers are typically an integrated circuit consisting of a CPU combined with support functions, such as a crystal oscillator, timers, watchdog timer, serial and optional analog I/O. A limited amount of read/write memory on the chip along with program memory in the form of reprogrammable flash or 'one-time programmable' ROM
<b>Microcontroller applications</b>	<p>Microcontroller applications are found in most industries. Typical applications include:</p> <ul style="list-style-type: none"> <li>• motor controllers</li> <li>• fault detectors</li> <li>• power controllers</li> <li>• communications</li> <li>• security systems</li> <li>• machine and process automation</li> <li>• automotive and transport applications</li> <li>• domestic appliances</li> <li>• medical equipment</li> </ul>
<b>Standards and codes</b>	Standards, codes and protocols refer to all relevant Australian and international standards, codes and protocols applicable to microprocessor related tasks

<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies may include: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, system interlocks and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems.</p>
<b>Network topologies</b>	<p>Network topologies include:</p> <ul style="list-style-type: none"> <li>daisy-chain, star, ring, branch, linear and tree</li> <li>wired and wireless options</li> </ul>
<b>Software for microcontroller applications</b>	<p>Software for microcontroller applications may include:</p> <ul style="list-style-type: none"> <li>integrated development environment software which may include programmer, editor, assembler, compiler, linker, simulator and emulator</li> <li>HMI software</li> <li>network software</li> <li>modem software</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of</p>

	<p>the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative WHS impact on employees, community and customer</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.



# **MEM23118A Apply production and service control techniques**

## **Modification History**

Release 1 - New unit. Replaces MEM23083A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the application of techniques for production and service control to maintain efficient and effective supply of product or service delivery to customers and to provide data for improvements to enhance competitiveness. This unit includes monitoring and measurement of quality, costs, quantities and reliability of processes in the value chain, including maintenance activities to ensure customer requirements. It requires the use of statistical process control (SPC), and control charts and the graphical representation of results.

## **Application of the Unit**

This unit applies to individuals who are required to control production and/or service delivery processes to ensure quality and for product manufacture or the provision of services to defined quality and operational requirements. It is suitable for people working as service providers, supervisors or technicians and those pursuing manufacturing, engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment
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## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Establish scope of required production or service control          | 1.1 | Identify products or services required by customers, including quality and delivery requirements  |
|   |  | 1.2 | Identify current production or service control tasks, key performance indicators (KPIs), and context within organisation strategic objectives and markets |
|   |  | 1.3 | Identify software techniques required for production or service control, communications and reporting   |
|   |  | 1.4 | Identify stakeholders to be consulted on the production or service control tasks  |
|   |  | 1.5 | Confirm work health and safety (WHS) and regulatory requirements, codes of practice, standards and risk assessment requirements                           |
| 2 | Review current data collection and production or service provision | 2.1 | Determine measurable parameters of production process or service delivery   |
|   |  | 2.2 | Determine parameters of product or service that are open to control and establish tolerances or acceptable variation                                      |
|   |  | 2.3 | Review process control functions  |
|   |  | 2.4 | Review production control performance indicators/indices  |
|   |  | 2.5 | Review the role of probability in sampling and SPC  |
|   |  | 2.6 | Review process capability and SPC evaluation, control charts and sampling   |
|   |  | 2.7 | Review features and functions of graphical methods for display of data  |

- |   |  |     |   |
|---|--|-----|---|
| 3 | Analyse data and apply production control principles to improve product manufacture or service provision | 3.1 | Obtain or record production or service data or appropriate data samples using a range of manual and automated devices   |
|   |  | 3.2 | Use software and control chart techniques to generate histograms, Pareto diagrams, flowcharts, tallycharts, scatter plots and/or run charts in accordance with procedures |
|   |  | 3.3 | Analyse data for trends and correlations and apply to process improvement, quality control and other support functions according to procedures                            |
|   |  | 3.4 | Determine process capability indices for an appropriate sample of a product or service delivery   |
|   |  | 3.5 | Establish required performance indicators for production or service operations  |
|   |  | 3.6 | Take corrective action in accordance with procedures  |
|   |  | 3.7 | Monitor production or service delivery using control charts to determine compliance of the product or service with specified performance limits                           |
|   |  | 3.8 | Take further corrective action, as required   |
| 4 | Report results   | 4.1 | Provide required reports  |
|   |  | 4.2 | Provide documentation, such as data, graphics, capability assessments, control and continuous improvement processes   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying production control task parameters and context within organisation strategic objectives and markets

- confirming stakeholder and support functional group interdependencies and communications, reporting and information flow
- determining controllable parameters of product or service and acceptable variation
- using manual and automatic methods for measurement, data gathering and analysis
- production of different charts used in production and service control, including:
  - histograms
  - Pareto diagrams
  - flowcharts
  - tallycharts
  - scatter plots
  - run charts
- applying a range of sampling plans to products or measurable aspects of services and justifying the choice of sampling plan
- analysing data for trends and correlations
- setting of KPIs capable of measurement and ongoing monitoring
- determining appropriate corrective actions based on analysis of measurable production or service performance parameters

## Required knowledge

Required knowledge includes:

- process capability, including:
  - capable processes definition
  - upper, lower and target specification limits
  - in-control
  - out-of-control, assignable causes and trends
  - corrective action plans, such as Western Electric, Wheeler or Nelson rules
  - capability indices
  - sample estimators
  - confidence intervals for indices and Chi square distribution
- role of production or process control in supporting lean processes, for example:
  - value stream management
  - standardised work
  - demand pull
  - just-in-time (JIT)
  - process levelling
  - cycle time
  - quick changeover
  - preventative maintenance
  - waste minimisation

- efficient process layout
- role of production control in quality maintenance:
  - mistake proofing process
  - defect detection, production halt and correction procedures
  - total quality management (TQM), quality assurance (QA) procedures and quality control (QC), and SPC processes
  - role of SPC and process capability
- production control performance indicators/indices
- applications where role of probability in sampling and SPC is important
- SPC, including:
  - data types and frequency distributions
  - population mean and standard deviation
  - sample mean and standard deviation
  - upper and lower specification limits and target
  - upper and lower process control limits and centre line
  - data mean and process control centre line offset
  - 3 sigma  $\sigma$  and 6 sigma  $\sigma$
  - sigma shift to account for long-term drift of data
- types and functions of control charts
- attributes and variables of sampling plans
- features and functions of graphical methods for display of data:
  - Ishikawa 'Fishbone' diagrams
  - histograms
  - Pareto analysis diagrams
  - flowcharts
  - tallycharts
  - scatter plots
  - run charts, including control charts
- types of manual and automated data collection and information flow

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to measure and analyse production or service performance data and apply techniques for process control to maintain
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	<p>efficient and effective production or supply or service to customers and to provide data for improvements to enhance competitiveness. This includes working individually and as part of a team in accordance with organisational procedures</p>
<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine measurable and controllable parameters of product or service,</li> <li>• determine acceptable variation of production or service parameters</li> <li>• use manual and automatic methods for measurement, data gathering and analysis</li> <li>• apply software and control chart techniques for SPC, performance analysis and graphical representations, including generating histograms, Pareto diagrams, flowcharts, tally charts, scatter plots and/or run charts from production or measurable service data</li> <li>• review production and service functions in order to recommend or make process improvements that are based on statistical analyses</li> <li>• identify WHS and regulatory requirements, risk management and related organisational procedures</li> <li>• report and document results.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<p><b>Method of assessment</b></p>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Production control related tasks</b>	<b>Production control related tasks</b> covered by this unit may include: <ul style="list-style-type: none"> <li>• measuring and recording data either manually or using automated data collection</li> <li>• determining process capability indices for a large sample of a product with a particular dimension normally distributed within upper and lower specification limits</li> <li>• applying a range of sampling plans to products or measurable aspects of services and justify the choice of sampling plan based on the properties required of the plan</li> <li>• applying control charts to a sample from a product or service to determine acceptability of the product or service within set limits (e.g. <math>3\sigma</math> and <math>6\sigma</math> limits)</li> <li>• analysing data for trends and taking corrective action in accordance with procedures</li> <li>• selecting and employing appropriate control charts from c-chart, p-chart and X-bar and R or np control charts</li> <li>• employing a Pareto analysis to determine priority issues for solutions related to a specific problem</li> </ul>
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<b>Process control</b>	Process control includes the qualitative and quantitative analysis of the process and production data necessary to ensure customer requirement
<b>Required performance indicators for production or service operations</b>	<p>Required performance indicators for production or service operations will vary according to the nature of the product or service and may include:</p> <ul style="list-style-type: none"> <li>• design features, such as dimensional and weight specifications and tolerances</li> <li>• production schedules</li> <li>• organisation or customer specified target error rates and waste, including those set under lean systems, such as 6σ</li> <li>• equipment availability indices</li> <li>• mass balancing targets</li> <li>• WHS related indicators (e.g. lost time injury)</li> <li>• takt time compliance</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Lean principles</b>	Lean principles and techniques use cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement.

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science



## Custom Content Section

Not applicable.

# MEM23119A Evaluate continuous improvement processes

## Modification History

Release 1 - New unit. Replaces MEM23083A, but not equivalent.

## Unit Descriptor

This unit of competency covers the evaluation of continuous improvement processes for production, engineering and associated services. It requires the evaluation of improvement processes, and the efficiency and effectiveness of their response to continuous feedback from customers and other sources. It requires consideration of the effect of improvements or change on entire systems.

## Application of the Unit

This unit applies to production and engineering activities where continuous improvements, such as those to product, process or service, efficiency or competitiveness, is required. It is suitable for people working as service providers, supervisors or technicians and those pursuing manufacturing, engineering or related technical qualifications and careers.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23118A	Apply production and service control techniques
MEM30012A	Apply mathematical techniques in a manufacturing, engineering or related environment

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential                      Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish scope of continuous improvement evaluation	1.1	Identify industrial and market context for continuous improvement
		1.2	Identify features, functions and measurable parameters of products, processes, systems or services, assets and operations subject to continuous improvement
		1.3	Assess software techniques required for continuous improvement
		1.4	Review sustainability implications of evaluation task
		1.5	Identify stakeholders in continuous improvement processes and appropriate licensed technical and professional assistance to be consulted on the tasks
		1.6	Determine compliance requirements of relevant work health and safety (WHS) and regulatory requirements, codes of practice, standards and risk assessment procedures
2	Prepare for evaluation	2.1	Identify appropriate measurement, data gathering, software and other analysis methods to be used for evaluation
		2.2	Identify performance criteria or indices
		2.3	Identify existing process capability, evaluation, control and run charts and sampling procedures
		2.4	Identify existing qualitative continuous improvement processes
3	Evaluate organisation continuous improvement	3.1	Evaluate manual and automatic methods for measurement of parameters of products or services
		3.2	Evaluate data gathering, analysis and performance indices

	processes	3.3	Evaluate software techniques for performance analysis and visual display generation
		3.4	Evaluate quantitative and qualitative continuous improvement processes
		3.5	Apply systems thinking, constraint and contingency management, problem solving and decision making to evaluation tasks
		3.6	Evaluate sustainability implications of improvements
4	Report results	4.1	Record results of scoping, identification of principles and techniques and evaluation of continuous improvement techniques
		4.2	Provide documentation, such as reports, data, graphics, flow charts and performance indices

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining suitability of measurable parameters of products, processes, systems and services for continuous improvement activities
- undertaking measurement, data gathering and analysis, including identifying trends and improvements
- reviewing performance indices, software for data analysis and visual representations and continuous improvement techniques
- evaluating continuous improvement, systems thinking, constraint and contingency management, and lean systems requirements
- producing and interpreting charts used in production and service control, including:
  - histograms
  - Pareto diagrams
  - flowcharts
  - tallycharts
  - scatter plots
  - run chart

- evaluating sustainability implications of improvements
- reporting and documenting results of scoping, identification of principles and techniques and evaluation of continuous improvement techniques, data, graphics, flow charts and performance indices

## Required knowledge

Required knowledge includes:

- features of products, processes, systems and services subject to improvement processes
- economic, social and sustainability implications of products, processes, systems, services and implications of improvement processes
- continuous improvement drivers and mechanisms, such as:
  - market competitiveness
  - maintenance of a technological edge
  - customer expectations
- WHS requirements, codes of practice, regulatory requirements, and standards problem solving and decision making techniques:
  - brainstorming
  - current and future state mapping
  - seven tools of quality:
    - Ishikawa 'Fishbone' diagrams
    - histograms
    - Pareto analysis
    - flowcharts
    - scatter plots
    - run charts
    - control charts
- data, performance metrics, graphics and visual indicators
- software options, such as:
  - budgeting, financial and business planning performance metrics analysers and graphics generators
  - maintenance downtime and cost data generators
  - system control and data acquisition (SCADA), distributed control systems (DCS), enterprise resource planning (ERP) and materials resource planning (MRP) system data generators
  - performance data analysis and graphics generators
- statistical process control (SPC) techniques
- qualitative improvement techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate continuous improvement processes for production, engineering and related services. This includes working individually and as part of a team in accordance with organisation procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine measurable and controllable parameters of product or service and their suitability in continuous improvement processes</li> <li>• identify WHS, regulatory requirements, risk management and related organisational procedures</li> <li>• evaluate manual and automatic methods for measurement and data gathering, including analysis and performance indices, software analysis and visual display</li> <li>• evaluate qualitative continuous improvement processes</li> <li>• evaluate sustainability implications of improvements</li> <li>• measure and gather data, record and analyse for trends and improvements</li> <li>• evaluate continuous improvement, systems thinking, constraint and contingency management and lean systems requirements</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>

<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Features, functions and measurable parameters of products, processes, systems or services, assets and operations subject to continuous improvement</b>	<p>Features, functions and measurable parameters of products, processes, systems, services and assets subject to continuous improvement may include:</p> <ul style="list-style-type: none"> <li>• sustainability</li> <li>• software</li> <li>• product manufacturability</li> <li>• process design</li> <li>• process control</li> <li>• equipment and tooling</li> <li>• material and product flow</li> </ul>
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	<ul style="list-style-type: none"> <li>• plant layout and transfer operations</li> <li>• standard operating procedures</li> <li>• maintenance</li> <li>• lean systems</li> <li>• labour and skills distribution</li> <li>• information flow</li> <li>• value chain</li> <li>• sales, marketing and planning</li> <li>• management</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular thermodynamic system task</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may</p>



	effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Continuous improvement processes</b>	<p>Continuous improvement processes may relate to plant, products, production processes, systems and services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> <li>• qualitative improvement processes, such as: <ul style="list-style-type: none"> <li>• toolbox meetings</li> <li>• suggestion schemes</li> <li>• mentoring</li> <li>• changes in work organisation, responsibilities and recruitment</li> </ul> </li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Lean principles</b>	<p>Lean manufacturing uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness</p>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.

# **MEM23120A Select mechanical machine and equipment components**

## **Modification History**

Release 1 - New unit. Replaces MEM23091A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the technical selection of mechanical machine and equipment components. It includes analysis of the application to determine suitability of components and use of performance analysis software.

## **Application of the Unit**

This unit applies to selecting components of machines or equipment based on mechanical engineering-related technical criteria in order to ensure appropriate performance and compliance with standards. The unit applies to selection tasks based on analyses completed by an individual or the use of technical criteria supplied by professional engineers or equipment suppliers. The use of calculus for technical analysis is not covered by this unit.

The unit is suitable for people working as mechanical detailers or designers and draftspersons and those pursuing careers and qualifications in mechanical engineering or related disciplines.

This unit does not cover selection of electric motors; electrical components; fluid power components, including pumps, control components and support structures; and structural fastening and welding with eccentric loadings. These are covered in other units.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Establish scope of machine components selection task     | 1.1 | Identify stakeholders to be consulted on selection tasks  |
|   |  | 1.2 | Determine relevant compliance requirements of work health and safety (WHS) and regulatory requirements, codes of practice, standards, and risk assessment requirements for machines and equipment |
|   |  | 1.3 | Review features and functions of mechanical machines and components   |
|   |  | 1.4 | Investigate sustainability implications of component selection task   |
|   |  | 1.5 | Establish availability of technical and professional assistance   |
| 2 | Examine technical specifications for component selection | 2.1 | Confirm performance requirements of particular machines or equipment components   |
|   |  | 2.2 | Select appropriate analysis techniques using graphs, tables, nomograms or computer-aided solutions, as appropriate  |
|   |  | 2.3 | Analyse operating conditions of components and determine component selection criteria   |
|   |  | 2.4 | Review design loads, working stresses, allowable deformations and factor of safety for machine components   |
|   |  | 2.5 | Determine component arrangement, limits, fits and clearances, assembly, fastening and alignment methods   |

3	Select machine components	3.1	Specify arrangement and assembly requirements
		3.2	Advise stakeholders of selection and make any required adjustments
		3.3	Ensure traceability of analysis and component selection
4	Report results	4.1	Record results of scoping, principles and techniques identification and component selection procedures
		4.2	Provide documentation, such as calculations, estimations, specifications, diagrams and drawings

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- applying safe working practices and procedures when working with machines and equipment
- component arrangement, limits, fits and clearances, assembly, fastening and alignment methods
- investigating sustainability implications of machine development, manufacture and use
- reviewing features and functions of machines and components
- identifying design features of machines, equipment and components, including:
  - loads
  - working stresses
  - allowable deformations and factor of safety
  - component arrangements
  - limits and fits
  - assembly, adjustment and fastening methods
- identifying relevant analysis support, such as graphs, tables, nomograms or computer-aided solutions and validation techniques
- selecting and specifying machine and equipment components, arrangement and assembly requirements
- communicating with stakeholders, professionals and technicians
- identifying and complying with relevant WHS and regulatory requirements and risk assessment procedures

- reporting and documenting results of component selection, including calculations, specifications, diagrams and drawings

## Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards and risk management requirements relevant to mechanical component selection processes
- current options and trends in performance analysis software, including underpinning program techniques and software validation techniques
- conditions for equilibrium
- reactions at beam supports (e.g. simply supported, overhung and cantilever beam with vertical and oblique concentrated, uniform and variable distributed loads and couples)
- shear force and bending moments, including diagrams
- vertical and oblique concentrated and uniform and variable distributed loads
- bending and shear stresses
- torsion distribution diagrams
- combined stresses
- properties of common machine and component materials
- stress concentration and fatigue due to alternating stresses
- deflection of beams
- bolted and welded connections with central loads (bolted joints may include friction forces)
- static versus dynamic forces, balanced and unbalanced
- dynamics and laws of rotational motion
- work and forms of mechanical energy and power
- dynamic systems
- mechanical power and drive efficiency
- mechanical drives
- block, band and disk brakes and clutches with single contact surface
- mechanical couplings and devices
- dynamic balancing of rotating masses
- stresses in flywheels
- stresses in thin walled pressure vessels

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select a wide variety of mechanical machine and equipment components for safety, economy and fitness for purpose. Selections must be able to be justified through appropriate engineering analysis.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine component arrangement, limits, fits and clearances, assembly, fastening and alignment of components</li> <li>• investigate sustainability implications of components selection task</li> <li>• review features and functions of machine and equipment components, design loads, working stresses, allowable deformations and factor of safety</li> <li>• select and specify machine components, including arrangement and assembly requirements</li> <li>• evaluate machine components and arrangements for compliance with WHS and regulatory requirements and risk assessment</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Machine and equipment components</b>	<p>Machine and equipment components for this unit are limited to components performing mechanical functions. Examples include:</p> <ul style="list-style-type: none"> <li>• shafts</li> <li>• bearings</li> <li>• couplings</li> <li>• power screws</li> <li>• gear drives</li> <li>• spur gears</li> <li>• chain and belt drives</li> <li>• brakes</li> <li>• clutches</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular selection of mechanical machine and equipment components task



<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability implications</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Analysis of machine and components</b>	<p>Analysis of machine and equipment components may include:</p> <ul style="list-style-type: none"> <li>• static and dynamic analysis of loads</li> <li>• the stresses and deformations resulting</li> <li>• the transmitted power, torque and speed</li> <li>• machine/operator interface in terms of ergonomics and safety</li> <li>• environmental effects, including noise, energy efficiency, heat generation and dust generation</li> <li>• graphical and mathematical methods and software options</li> </ul>
<b>Appropriate computer-aided solutions and validation techniques</b>	<p>Appropriate computer-aided solutions include:</p> <ul style="list-style-type: none"> <li>• performance analysis and computer-aided design (CAD) modelling</li> </ul> <p>Validation techniques include:</p>

	<ul style="list-style-type: none"><li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li><li>• review of previously implemented design challenges which were completed using the software</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

## MEM23121A Analyse loads on frames and mechanisms

### Modification History

Release 1. Replaces MEM23091A, but not equivalent.

### Unit Descriptor

This unit of competency covers the analysis of loads on mechanisms, frames and structural support elements, such as linkages, rods, shafts and beam elements within machines and mechanisms. It includes safe working practices, work health and safety (WHS) compliance requirements, function and features of frames and mechanisms, load and deflection analysis for static and dynamic elements, and traditional and software-based techniques.

### Application of the Unit

This unit applies to the analysis of loads on mechanisms, beams, frames and support elements either individually or with the assistance of a professional engineer for more complex calculations of loads and stresses. It is suitable for people working as mechanical detailers or designers and draftspersons, and those pursuing careers and qualifications in mechanical engineering or related disciplines.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23007A	Apply calculus to engineering tasks
MEM23109A	Apply engineering mechanics principles

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Establish scope of frame and mechanism analysis        | 1.1 Determine compliance requirements of relevant WHS and regulatory requirements, codes of practice, standards and risk assessment and for design and use of machines and equipment<br><br>1.2 Identify features, functions, operating conditions and performance requirements of frames, beams and mechanisms<br><br>1.3 Investigate sustainability implications of frames and mechanisms<br><br>1.4 Review design loads, working stresses, allowable deformations and factor of safety for elements<br><br>1.5 Review element arrangements, assembly and fastening methods<br><br>1.6 Identify any complex load calculations to be done with or obtained from a professional engineer<br><br>1.7 Establish availability of other technical and professional assistance<br><br>1.8 Identify and evaluate appropriate analysis techniques, software and software validation techniques<br><br>1.9 Identify stakeholders to be consulted on selection tasks |
| 2 | Analyse loads and performance of frames and mechanisms | 2.1 Estimate static and dynamic operating conditions and determine design or selection parameters<br><br>2.2 Optimise frame, beam and mechanism elements for strength, deflection, arrangement and fastening<br><br>2.3 Review analysis with stakeholders and make any required adjustments   |

- |   |                |   |
|---|----------------|---|
|   | 2.4            | Confirm compliance of frames and mechanisms with WHS and regulatory requirements, standards and codes of practice |
| 3 | Report results | 3.1 Record results of scoping, principles and techniques identification and analysis                              |
|   |                | 3.2 Provide documentation, such as calculations, specifications diagrams and drawings                             |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- applying safe working practices and procedures when working with frames, mechanisms and equipment
- evaluating frames, beams and mechanisms for WHS, regulations and risk management requirements
- investigating sustainability implications of frames and mechanisms
- reviewing design features, functions and performance requirements of frames, beams and mechanisms, including:
  - dynamics
  - design loads
  - working stresses
  - allowable deformations and factor of safety element arrangements
  - assembly and fastening methods
- selecting appropriate analysis techniques, software and software validation techniques
- identifying relevant analysis support, such as graphs, tables, nomograms or computer-aided solutions and validation techniques
- analysing static and dynamic operating conditions and determining design or selection parameters
- optimising frame, beam and mechanism elements for strength, deflection, arrangement and fastening
- communicating with stakeholders
- reporting and documenting results of analysis, including calculations, specifications, diagrams and drawings

## Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, and directives and standards, including those related to risk management
- current options and trends in performance analysis software, including underpinning program and software validation techniques
- types and functions of frames and mechanisms
- mechanisms for converting linear to rotary motion and rotary to linear motion
- lifting machines
- design loads, working stresses, allowable deflections and factor of safety for machine elements
- conditions for equilibrium
- non-coplanar and force systems
- equilibrium of non-coplanar and non-concurrent force systems
- reactions at beam supports (e.g. simply supported, overhung and cantilever beam with vertical and oblique concentrated, uniform and variable distributed loads and couples)
- shear force and bending moments
- shear force and bending moment diagrams
- vertical and oblique concentrated and uniform and variable distributed loads
- types and locations of stresses, including:
  - combined stresses
  - thermal stress due to restrained expansion
  - stress concentration and fatigue due to alternating stresses
- centre of gravity
- centre of percussion
- methods of analysis of frames and trusses
- deflection of beams
- statically indeterminate beams
- buckling of compressed members
- loads and stresses on bolted and welded connections
- static versus dynamic forces, balanced and unbalanced
- dynamics and laws of rotational motion
- dynamic analysis of mechanisms
- linked bodies in motion, including types, impulse, momentum and work energy methods
- work, energy and power for balanced and unbalanced force systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to analyse loads on a variety of frames and mechanisms to confirm performance and safety compliance.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify and review features, functions and performance requirement of frames, beams and mechanisms</li> <li>• identify complex calculations requiring professional engineering assistance</li> <li>• establish dynamics, design loads, working stresses, allowable deformations and factor of safety element arrangements for calculations to be done</li> <li>• evaluate assembly and fastening methods, analysis techniques, software and software validation techniques</li> <li>• analyse static and dynamic operating conditions and determine design or selection parameters</li> <li>• optimise frame, beam and mechanism elements for strength, deflection, arrangement and fastening</li> <li>• communicate and negotiate with stakeholders, professionals and technicians and make adjustments accordingly</li> <li>• evaluate frames, beams and mechanisms for WHS and regulatory requirements, and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics</li> </ul>

	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Structural support and machine elements</b>	<p>Typically these are beam, strut and tie elements of machines and machine supports subject to bending, tension, compression and shear stresses, and may include:</p> <ul style="list-style-type: none"> <li>shafts, levers, cams and linkages</li> <li>frames, staunchions and beams</li> </ul>
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	<ul style="list-style-type: none"> <li>mechanisms for converting linear to rotary motion and rotary to linear motion</li> <li>mechanisms with up to five linkages</li> <li>lifting machines</li> </ul>
<b>Machine mechanisms</b>	<p>Machine mechanisms refers to a device to produce a constrained motion while producing a required output. A mechanism is an assembly of elements or links which may be called 'kinematic pairs', which remain in contact throughout their motions. One link, typically the base element, is fixed.</p> <p>Kinematic pairs may be described as turning, sliding, rolling or skidding pairs</p>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and International standards and codes applicable to a particular frame and mechanism</p>
<b>Load calculations to be done with, or obtained from, a professional engineer</b>	<p>The unit requires the ability to identify calculations that should be obtained from or calculated with the assistance of a professional engineer. These may include:</p> <ul style="list-style-type: none"> <li>regulatory or organisational requirement for professional engineer involvement</li> <li>static and dynamic complex analysis of loads, including resulting stresses and deformations</li> <li>choice of graphical and mathematical methods and software options</li> </ul>
<b>Appropriate licensed technical and professional assistance</b>	<p>Appropriate licensed technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low</li> </ul> </li> </ul>

	<p>voltage</p> <ul style="list-style-type: none"> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Appropriate computer-aided solutions and validation techniques</b>	<p>Appropriate computer-aided solutions may include:</p> <ul style="list-style-type: none"> <li>• software employed for performance analysis/modelling. Underpinning program techniques and algorithms should be understood, such as the use of finite element analysis (FEA) and numerical methods within object oriented modelling techniques</li> </ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented design challenges which were completed using the software</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.



# **MEM23122A Evaluate computer integrated manufacturing systems**

## **Modification History**

Release 1 - New unit. Replaces MEM23092A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the evaluation of computer integrated manufacturing (CIM) systems. It includes hardware, controllers, networks and data handling for business, planning and control, manufacturing operations, automation safety, work health and safety (WHS) and risk management compliance, software and system integration.

## **Application of the Unit**

This unit applies to evaluation of computer integrated systems used in manufacturing. It is suitable for people working as manufacturing technicians or paraprofessionals and draftspersons and those pursuing manufacturing, engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                     |     |   |
|---|-------------------------------------|-----|---|
| 1 | Determine scope of CIM application  | 1.1 | Identify stakeholders to be consulted on the evaluation   |
|   |                                     | 1.2 | Confirm that appropriate support, including technical and professional assistance, is available   |
|   |                                     | 1.3 | Identify WHS and regulatory requirements, codes of practice, standards and risk assessment requirements for CIM systems with particular emphasis on automation safety |
|   |                                     | 1.4 | Identify appropriate analysis techniques, software techniques and graphics required for evaluation  |
|   |                                     | 1.5 | Identify stakeholders to be consulted on evaluation tasks   |
|   |                                     | 1.6 | Investigate sustainability implications of CIM systems  |
| 2 | Evaluate CIM components and systems | 2.1 | Evaluate parameters and requirements of manufacturing operations  |
|   |                                     | 2.2 | Evaluate machines, processes and data flow for machine and process control in CIM systems   |
|   |                                     | 2.3 | Evaluate system control, signal generation and conditioning, controller functions and actuator power interfacing  |
|   |                                     | 2.4 | Evaluate data collection, sharing and control software and programming for hardware integration   |
|   |                                     | 2.5 | Evaluate the data and communications protocols, standards and network topologies for the applications   |
|   |                                     | 2.6 | Evaluate system integration of hardware, controllers, human-machine interfaces (HMIs) and graphical user interfaces (GUIs) and network                                |

- |   |                |   |
|---|----------------|---|
|   | 2.7            | Evaluate system analysis and simulation software and validation techniques  |
|   | 2.8            | Evaluate automation safety and compliance with WHS, regulatory requirements, standards and risk management implementation |
| 3 | Report results |   |
|   | 3.1            | Record results of scoping, principles and techniques identification and evaluation of systems                             |
|   | 3.2            | Provide documentation, such as layouts, programs, flow charts and files   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required knowledge includes:

- relating manufacturing context and requirements to existing or planned CIM applications and continuous improvement requirements
- identifying WHS, regulatory requirements and risk management compliance
- evaluating CIM systems against automation safety requirements
- investigating sustainability implications of CIM systems
- evaluating features and functions of existing or planned CIM systems against:
  - components
  - processes and data flow
  - controller functions
  - signal and power interfacing
  - communications protocols
  - standards and network topologies
  - HMIs and software
  - automation safety
  - compliance with WHS and regulatory requirements
- applying CIM related software analysis, and software validation techniques
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

## Required knowledge

Required knowledge includes:

- types of manufacturing operations, their features and parameters and potential for CIM applications, for example:
  - continuous, mass, batch and jobbing
  - prototype manufacture
  - cellular manufacturing
  - jobbing
  - just-in-time (JIT) and other lean manufacturing systems and techniques
  - maintenance systems and techniques (e.g. condition monitoring)
- compliance requirements of WHS and regulatory requirements, codes of practice, standards, and risk assessment for CIM systems with particular emphasis on automation safety
- sustainability implications of CIM systems
- CIM hardware
- CIM principles and techniques required to evaluate systems and select and optimise components
- current options and trends in performance analysis and programming software, including underpinning program techniques and algorithms
- LAN and WAN network communications in CIM applications
- documentation, drawings, specifications, instructions required, process information and programming
- interdependencies and communications linkages between team members, support functional groups, and licensed technical and professional support

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate CIM systems for safety, economy and fitness for purpose. This includes working individually and as part of a team in accordance with organisational procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• evaluate compliance with WHS, regulatory requirements and risk management with particular emphasis on automation safety</li></ul>

	<ul style="list-style-type: none"> <li>investigate sustainability implications of CIM systems</li> <li>review features and functions of CIM systems</li> <li>identify CIM principles and techniques, analysis, software and software validation techniques</li> <li>evaluate parameters of manufacturing operations and the features and suitability of CIM components and systems</li> <li>report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for</b>	Assessment processes and techniques must be culturally



<b>assessment</b>	appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>CIM</b>	CIM uses mechatronic and manufacturing technologies integrated across an enterprise by the communication of data to control plant and operations, plan production, marketing, maintenance and feedback to the business planning process
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to CIM applications and systems
<b>Automation safety</b>	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, system interlocks and data integrity. Standards apply to general plant design and use as well as the 'functional safety of safety-related electrical, electronic and programmable electronic control systems'
<b>Appropriate technical and professional assistance</b>	Appropriate technical and professional assistance may include: <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	WHS, regulatory requirements and enterprise procedures may include:

	<ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>CIM hardware</b>	<p>Hardware options for CIM systems may include:</p> <ul style="list-style-type: none"> <li>• robots</li> <li>• pick and place, materials handling, automated guided vehicles (AGVs) and transfer devices</li> <li>• fluid power components</li> <li>• pumping and wash equipment</li> <li>• boilers, heating and drying equipment</li> <li>• pasteurising, chilling and refrigeration equipment</li> <li>• welding equipment</li> <li>• moulding, casting and forging equipment</li> <li>• pressing, forming, drawing and cropping equipment</li> <li>• surface finishing, plating and painting</li> <li>• packaging equipment</li> <li>• mechanical linkages and support structures</li> <li>• pressure, temperature, proximity sensor/transducers, relative and absolute encoders, vision systems and smart cameras</li> <li>• controllers, programmable logic controllers (PLCs) and remote telemetry units (RTUs)</li> <li>• HMIs (e.g. touch screens)</li> <li>• power interfaces and signal processors for digital and analog control</li> <li>• stepper motors</li> <li>• servo motors, torque, speed and position control</li> <li>• special purpose equipment (e.g. package labelling equipment, logistics and warehousing requirements)</li> <li>• wired and wireless networking systems</li> </ul>
<b>Data and communications protocols and standards</b>	<p>Data and communications protocols and standards include the set of standardised rules for data and signal syntax, checking and error detection. Hardware and software generate data in accordance with a protocol that allows generators and receivers to understand or translate the data as information, control signals integrity and error checks. These may include the following or their current updates:</p> <ul style="list-style-type: none"> <li>• layered communications and networking protocols</li> <li>• Open Systems Interconnection Model (OSI Model) – 7 layers</li> </ul>

	<ul style="list-style-type: none"> <li>• TCP/IP Internet Protocol Suite {Transmission Control Protocol (TCP) and the Internet Protocol (IP)} – 4 or 5 layers</li> <li>• IEEE 802 LAN/MAN group of standards, including IEEE 802.3 Ethernet standard, IEEE 802.11 Wireless networking standard</li> <li>• Interface standards, such as: RS232 and RS485, Fieldbus, Modbus and DNP3.0</li> </ul>
<b>Network topology</b>	<p>Network topology refers to the arrangement of connected hardware. These include:</p> <ul style="list-style-type: none"> <li>• bus, ring, star, tree, mesh and in-line (2 way comms.) arrangements</li> <li>• wired and wireless options</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.

## **MEM23123A Evaluate manufacturing processes**

### **Modification History**

Release 1 - New unit. Replaces MEM23093A, but not equivalent.

### **Unit Descriptor**

This unit of competency covers the evaluation of plant, facilities, services, labour and skills distribution used for manufacturing processes against defined process performance parameters. It includes the evaluation and assessment of plant layout and material flows for efficient manufacturability of product and maintainability of the plant and process.

### **Application of the Unit**

This unit applies to manufacturing processes for products, machinery, tools or components for structures. Evaluations may be required for a variety of reasons, including assessing impact of proposals for new products or investigating potential change in processes to meet regulatory, sustainability or efficiency requirements. Efficiency evaluations are based on lean systems and techniques. Where more in-depth training in lean systems and techniques is required relevant competitive systems and practices units should be selected.

The unit is suitable for people working as, supervisors, technicians, and design draftspersons and those pursuing manufacturing, engineering or related technical qualifications and careers.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Determine scope of manufacturing processes | 1.1 | Identify manufacturing context and processes  |
|   |  | 1.2 | Identify features and functions of plant, facilities, services, labour and skill distribution used for manufacturing processes  |
|   |  | 1.3 | Identify stakeholders to be consulted as part of the evaluation   |
|   |  | 1.4 | Confirm work health and safety (WHS) and regulatory requirements, codes of practice, standards, risk assessment and registration requirements for manufacturing plant |
|   |  | 1.5 | Investigate sustainability implications of manufacturing processes  |
|   |  | 1.6 | Identify sources of professional and technical assistance   |
| 2 | Evaluate manufacturing processes           | 2.1 | Identify manufacturing principles and techniques required to evaluate and optimise the processes  |
|   |  | 2.2 | Identify appropriate analysis techniques, software and software validation techniques   |
|   |  | 2.3 | Evaluate and assess facilities, services, plant and tooling in relation to product manufacturability and maintainability  |
|   |  | 2.4 | Evaluate and assess process layout, use of automation and process control using lean systems and techniques   |
|   |  | 2.5 | Evaluate and assess materials, product flow and transfer operations, buffer and emergency stocks, warehousing, stores and logistics using lean systems and techniques |
|   |  | 2.6 | Evaluate WHS and regulatory compliance and risk management practices of manufacturing processes and maintenance procedures  |
|   |  | 2.7 | Evaluate processes for sustainability   |

- |   |                |  |
|---|----------------|--|
|   | 2.8            | Evaluate process compatibility with maintenance management system            |
|   | 2.9            | Evaluate labour requirements and skills distribution                         |
|   | 2.10           | Evaluate process information flows for control and process improvement       |
| 3 | Report results |  |
|   | 3.1            | Review results of evaluation and assessment with stakeholders                |
|   | 3.2            | Provide recommendations for improvements, where appropriate                  |
|   | 3.3            | Provide reports and documentation, such as layouts, programs and flow charts |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying parameters and context of manufacturing processes
- investigating sustainability implications of manufacturing processes
- identifying appropriate manufacturing processes and analysis techniques and software
- evaluating WHS and regulatory requirements, automation safety and risk management compliance, sustainability and standards
- investigating existing or planned software against manufacturing technical and efficiency requirements
- applying lean systems and techniques to evaluate:
  - facilities and services
  - plant and tooling
  - process layout
  - automation and process control
  - materials and product flow
  - buffer and emergency stocks
  - stores and warehousing
  - transport and logistics

- maintenance management system
- labour and skill requirements
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

## Required knowledge

Required knowledge includes:

- important features of products and processing options with regard to:
  - marketing options and advantages
  - economic, social and sustainability implications of products and processes
  - WHS and other regulatory requirements
- plant, facilities, services and process layout
- range of common modern manufacturing technical and work organisation processes, including:
  - volume production using transfer lines
  - cellular manufacturing
  - jobbing
  - metal shaping processes, such as casting, forging and machining
  - metal assembly, fabricating and joining
  - plastic and rubber product manufacturing, including various types of moulding and assembly
  - surface finishing based processes (e.g. electroplating)
  - process transfers and materials handling
  - packaging
  - warehousing, stores, and provision for logistics and transport
- labour and skills distribution requirements of plant and processes
- asset maintainability and reliability concepts and processes
- process automation and control options
- techniques for process improvement, including:
  - material and product flow measurement and improvement
  - feedback on product manufacturability for possible product modification
  - feedback from maintenance and life cycle costs for plant
  - quality assurance (QA), quality control (QC) and statistical process control (SPC) feedback
  - customer feedback on cost, quality, delivery and reliability
- maintenance management systems and compatibility with manufacturing processes
- information flows and software options for process measurement and control
- budgeting and costing processes
- WHS, risk management, safe work methods statements (SWMS), work permits, material safety data sheets (MSDS), codes of practice, regulations, standards and regulatory



requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate plant, facilities, services and processes against defined process performance parameters. This includes working individually and as part of a team in accordance with organisational procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine features and functions of manufacturing processes, including manufacturing principles and techniques used and relevant internal and external context of manufacturing processes</li> <li>• identify relevant lean systems and techniques and apply in evaluation of manufacturing processes</li> <li>• evaluate WHS, regulatory, automation safety and risk management compliance</li> <li>• investigate sustainability implications of manufacturing processes</li> <li>• evaluate software, facilities, services, plant and equipment tooling, process layout, automation and process control</li> <li>• identify appropriateness of materials and product flow and transfer operations, buffer and emergency stocks, warehousing, stores and compatibility of maintenance management system</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be</li> </ul>

	<p>made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Defined parameters</b>	<p>Defined parameters may include</p> <ul style="list-style-type: none"> <li>target cost</li> <li>target outgoing quality levels and warranty costs</li> </ul>
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	<ul style="list-style-type: none"> <li>• production rates</li> <li>• stock levels and availability to customer order</li> <li>• productivity</li> <li>• working capital</li> <li>• plant utilisation</li> </ul>
<b>Context of manufacturing processes</b>	<p>The context of manufacturing operations includes:</p> <ul style="list-style-type: none"> <li>• customer requirements</li> <li>• market considerations</li> <li>• product and process sustainability</li> <li>• lean systems</li> <li>• product manufacturability</li> <li>• system maintainability</li> <li>• facilities, services, plant and tooling requirements</li> <li>• supply chains</li> <li>• material and product flow</li> <li>• transfer operations</li> <li>• process control</li> <li>• labour requirements and skills distribution</li> <li>• information flow</li> <li>• systems thinking</li> <li>• continuous improvement and constraint and contingency management</li> <li>• WHS and regulatory requirements and risk management</li> </ul>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems</p>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment,</li> </ul> </li> </ul>

	sealing and fastening
<b>WHS, regulatory requirements, codes of practice and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular manufacturing process
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement of manufacturing processes may result in changes to plant, facilities, services, layout, materials flows, handling and logistics. It may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> <li>• systems thinking</li> <li>• constraints and contingency management</li> </ul>
<b>Lean systems and</b>	Lean systems and techniques used in evaluations can vary

<b>techniques</b>	<p>according the type of production and product and may include:</p> <ul style="list-style-type: none"> <li>• performance indicators based on customer value</li> <li>• continuous improvement, including kaizen</li> <li>• just-in-time (JIT) and kanban</li> <li>• pull system for production and services</li> <li>• elimination and/or limitation of waste, where waste is defined as effort and resources not contributing to customer value</li> <li>• mistake proofing</li> <li>• standardisation of work</li> <li>• quick changeover</li> <li>• planning benchmarks and techniques: <ul style="list-style-type: none"> <li>• cycle time</li> <li>• takt time</li> <li>• pack out</li> <li>• pitch</li> <li>• line balancing</li> <li>• overall equipment effectiveness (availability x performance efficiency x quality rate)</li> </ul> </li> <li>• problem solving and decision making tools: <ul style="list-style-type: none"> <li>• total quality management (TQM) tools</li> <li>• root cause analysis (RCA)</li> <li>• failure mode and effects analysis (FMEA)</li> <li>• design review based on failure mode (DRBFM)</li> <li>• constraints and contingencies management</li> </ul> </li> <li>• total productive maintenance</li> <li>• value stream analysis</li> <li>• visual factory techniques</li> </ul>
<b>Automation</b>	<p>Automation options range from manual operations with manual information generation, handling, analysis and storage to islands of automation supported by manual interfaces with some electronic information processing to systems with major automation and networked data handling</p>
<b>Information flow requirements</b>	<p>Information flow may include:</p> <ul style="list-style-type: none"> <li>• SPC and QA data</li> <li>• production planning and maintenance systems information</li> <li>• visual information feedback to stakeholders</li> </ul> <p>Information processing may include:</p> <ul style="list-style-type: none"> <li>• software and networks for automated data handling, analysis, display and storage</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

# **MEM23124A Measure and analyse noise and vibration**

## **Modification History**

Release 1 - New unit. Replaces MEM23094A, but not equivalent.

## **Unit Descriptor**

This unit of competency covers the monitoring, measurement and analysis of noise and vibration. It includes equipment calibration and use, analysis of data, standards for exposure limits, work health and safety (WHS) and mitigation measures.

## **Application of the Unit**

This unit applies to machinery and equipment generated noise and vibration, including mechanical shock generated in commercial and industrial environments.

It is suitable for people working as asset maintenance technicians or noise and vibration specialists. It is suitable for people working as technicians in engineering or related industries and those pursuing careers and qualifications in engineering or related disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Determine scope of investigation into noise or vibration | 1.1 | Identify machinery and equipment to be investigated for noise and vibration measurement and analysis                   |
|   |  | 1.2 | Determine stakeholders to be consulted on analysis tasks   |
|   |  | 1.3 | Determine software required for the analysis of the task   |
|   |  | 1.4 | Determine regulatory, standards and risk management noise and vibration compliance requirements                        |
|   |  | 1.5 | Investigate sustainability implications of noise and vibration   |
|   |  | 1.6 | Apply systems thinking, continuous improvement problem solving and constraint and contingency management               |
|   |  | 1.7 | Determine available sources for any required technical and professional assistance                                     |
|   |  |     |  |
| 2 | Prepare for noise measurement and analysis               | 2.1 | Identify noise exposure limits appropriate to the equipment, process and employee, community and environmental context |
|   |  | 2.2 | Review and identify available sound measuring equipment and components and suitability for required measurements       |
|   |  | 2.3 | Select sound measuring equipment   |
|   |  |     |  |
| 3 | Measure and analyse sound data                           | 3.1 | Set up and site sound measurement equipment for desired measurements   |
|   |  | 3.2 | Calibrate sound measurement equipment  |
|   |  | 3.3 | Take sound measurements using appropriate techniques for particular application and environment                        |
|   |  | 3.4 | Process, analyse and interpret noise data  |



		3.5	Relate data to plant and equipment performance
4	Review options for noise elimination or mitigation and protection	4.1	Review options for noise elimination, mitigation and protection measures
		4.2	Prepare report and make recommendations
5	Prepare for vibration measurement and analysis	5.1	Identify vibration exposure limits appropriate to the equipment, process and employee, community and environmental context
		5.2	Review and identify available vibration measuring equipment and components and suitability for required measurements
		5.3	Select vibration measuring equipment
6	Measure and analyse vibration and shock data	6.1	Set up and site or mount vibration and shock measurement equipment
		6.2	Calibrate equipment
		6.3	Take measurements
		6.4	Process, analyse and interpret vibration and shock data
		6.5	Relate data to plant and equipment performance
7	Review options for vibration and shock elimination or mitigation and protection	7.1	Review options for vibration and shock elimination or damping and isolating
		7.2	Prepare report and make recommendations
8	Investigate developments in the field of noise and vibration measurement in	8.1	Investigate developments in acoustic, vibration and shock measurement
		8.2	Investigate the use of condition monitoring in predictive maintenance programs

predictive  
equipment  
maintenance

- |   |                   |     |  |
|---|-------------------|-----|--|
| 9 | Record and report | 9.1 | Record and report results of review, measurement, analysis and recommendations         |
|   |                   | 9.2 | Provide documentation, such as calculations, data records and analysis and assessments |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining parameters and context of noise and vibration measurement and analysis tasks
- determining WHS, other regulatory and risk management compliance requirements, including noise and vibration, noise dose and vibration exposure limits
- reviewing physics of sound and vibration, effects of noise, vibration and shock on humans, measuring equipment and mitigation measures
- selecting equipment
- siting, setting up and calibrating equipment prior to use
- measuring, analysing, interpreting and recording
- relating data to plant and equipment performance
- applying systems thinking, continuous improvement problem solving and constraint and contingency management
- investigating sustainability implications, developments in acoustic, vibration and shock measurement, condition monitoring in predictive maintenance programs
- recording, reporting and documenting results of review, measurement, data, analysis and calculations, interpretations and recommendations

### Required knowledge

Required knowledge includes:

- characteristics and measurement of noise and vibration, and sources of noise and vibration
- noise and vibration concepts and terminology
- ISO and other vibration severity standards
- limitations of broadband vibration and trend analysis

- principles of using vibration analysis as an indicator of machine and equipment condition
- causes and effects of vibration and noise in industrial and commercial equipment, such as damaged product, limited processing speeds and catastrophic machine failure
- typical engineering components subject to vibration
- relevant WHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- calculations, formulae and laws relating to vibration and sound measurement, including allowable exposure using AS 2670 Physiological effects of noise and vibration
- range and capacity of equipment for measuring vibration and sound
- noise measurement and testing techniques and equipment for various environments and sound characteristics in vibration measurement and testing
- acoustic emission in vibration measurement and testing
- shock testing, including applications requiring laboratory testing (e.g. anechoic chambers)
- vibration trend analysis
- noise and vibration concepts (e.g. vibration, noise, transmission of noise and vibration and harmonic excitation)
- common sources of noise generation (e.g. fans, motors, engines and ducts)
- noise mitigation and protection measures, such as:
  - isolation
  - insulation
  - personal hearing protection
  - exposure limitation policies
- vibration and shock control equipment and techniques
- community noise
  - noise and vibration measurement and analysis applications, such as:
    - condition monitoring for plant
    - acoustic emissions for fault detection
    - modal analysis of dynamic properties of structures or room acoustics
    - correlation of modal analysis with finite element analysis (FEA)
    - statistical energy analysis

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to measure and analyse noise and vibration and make recommendations for mitigation and protection.
<b>Critical aspects for</b>	Assessors must be satisfied that the candidate can competently

<b>assessment and evidence required to demonstrate competency in this unit</b>	<p>and consistently:</p> <ul style="list-style-type: none"> <li>• determine compliance with WHS and regulatory requirements, and risk management with particular emphasis on automation safety</li> <li>• review physics of sound and vibration, effects of noise, vibration and shock on humans, measuring equipment and mitigation measures</li> <li>• identify noise and vibration, noise dose and vibration exposure limits</li> <li>• select appropriate measuring equipment for measuring task</li> <li>• calibrate, site and set up equipment</li> <li>• correctly measure and record noise and vibration</li> <li>• analyse and interpret measurement results</li> <li>• relate data to plant and equipment performance</li> <li>• recommend noise and vibration elimination, mitigation and protection measures</li> <li>• investigate sustainability implications</li> <li>• report and document results and recommendations</li> <li>• apply systems thinking, continuous improvement problem solving and constraint and contingency management.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> </ul>

	<ul style="list-style-type: none"> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Sound measuring equipment</b>	Sound measuring equipment may include: <ul style="list-style-type: none"> <li>microphones</li> <li>cables/connectors</li> <li>meters</li> <li>recorders</li> <li>analysers/comper and software</li> </ul>
<b>Set-up and measurement techniques</b>	Set-up and measurement techniques may include: <ul style="list-style-type: none"> <li>microphone positioning</li> <li>meter time constants</li> <li>frequency filter settings</li> </ul>
<b>Purpose for sound measurements</b>	Purposes for sound measurements may include: <ul style="list-style-type: none"> <li>simple sound level or spectrum</li> <li>limited or full frequency band</li> <li>standards to be met</li> <li>impulsive or consistant noise</li> </ul>
<b>Vibration</b>	Vibration refers to continuous or sporadic vibration whether or not associated with noise and also includes mechanical shock
<b>Vibration and shock measuring equipment</b>	Vibration and shock measuring equipment may include: <ul style="list-style-type: none"> <li>accelerometer</li> <li>impedance heads</li> </ul>

	<ul style="list-style-type: none"> <li>• cables</li> <li>• mounting media</li> <li>• calibrators</li> <li>• preamplifier</li> <li>• meters</li> <li>• filters</li> <li>• recorders</li> <li>• analysers/computer and software</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and International standards and codes applicable to a particular noise and vibration measurement and analysis task</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and</p>

	techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Continuous improvement</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# MEM23125A Evaluate maintenance systems

## Modification History

Release 1 - New unit. Replaces MEM23094A, but not equivalent.

## Unit Descriptor

This unit of competency covers the evaluation of maintenance management systems, including analysing the effect of any action or breakdown on achieving strategic objectives. The unit requires evaluation of maintainability and reliability of assets, maintenance management systems, personnel participation, monitoring, responding to indicators, prioritising action, sustainability, lean systems maintenance requirements, work health and safety (WHS) compliance, risk minimisation, facilities and services maintenance, costing and data analysis, and performance indices.

## Application of the Unit

This unit applies to evaluation of both corrective and preventative maintenance systems for plant, facilities and services used in industry. Evaluations may be required for variety of purposes and may apply to evaluations of a maintenance system for a whole process, plant or enterprise. The unit is suitable for operations managers, maintenance personnel and those pursuing maintenance or manufacturing, engineering or related technical qualifications and careers.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM14088A	Apply maintenance engineering techniques to equipment and component repairs and modifications
MEM14092A	Integrate maintenance fundamentals into an engineering task



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of maintenance processes	1.1	Determine parameters of maintenance management system to be evaluated
		1.2	Assess engineering principles, skills and techniques required by tasks
		1.3	Assess software and software techniques required for evaluation task
		1.4	Identify stakeholders to be consulted
		1.5	Determine compliance requirements of WHS and regulatory requirements, codes of practice, standards and risk assessment requirements for maintenance processes
		1.6	Investigate sustainability implications of maintenance processes
2	Identify principles and techniques required by evaluation	2.1	Review trends in maintenance practice and equipment with particular emphasis on integrated management systems
		2.2	Review maintenance system and implementation strategies for relevance to evaluation
		2.3	Identify features and functions of maintenance information systems
3	Evaluate	3.1	Evaluate organisational maintenance safety and risk

maintenance management systems	management procedures	
	3.2	Evaluate maintenance processes for sustainability
	3.3	Evaluate asset reliability, maintainability and performance against lean indices, production targets and system design parameters
	3.4	Audit plant, facilities, services and systems for provision of parts and consumables, adequacy of labour, skills and technical support
	3.5	Evaluate maintenance system data generation and collection and reporting for performance analysis required for process improvement
	3.6	Evaluate the use of maintenance management software
	3.7	Evaluate manual and automated condition monitoring, testing and analysis
	3.8	Evaluate implementation of maintenance management systems techniques, including up-time preparations, spares availability, tooling and equipment readiness
	3.9	Evaluate asset categorisation, maintenance scheduling and prioritising
	3.10	Evaluate implementation of maintenance continuous improvement processes
4	Report results	
	4.1	Record results of scoping, principles and techniques identification and evaluation of maintenance systems
	4.2	Provide documentation, such as layouts, schedules, performance analysis and flow charts

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying WHS, regulatory and risk management compliance requirements for maintenance systems
- investigating sustainability implications of maintenance processes
- identifying and reviewing features and functions of maintenance and information systems, trends and implementation strategies and software
- evaluating organisational maintenance safety and risk management procedures, sustainability, asset reliability and maintainability, lean indices, system design parameters, data generation and collection, reporting, storage and analysis, condition monitoring, implementation, facilities and services maintenance response systems, asset categorisation, maintenance scheduling and prioritising, and continuous improvement
- auditing plant, facilities and services, systems for provision of parts and consumables, and adequacy of labour, skills and technical support for maintenance activities
- reporting and documenting results of scoping, principles and techniques identification and evaluation of maintenance systems, layouts, schedules, performance analysis, flow charts, calculations, programs and files

## Required knowledge

Required knowledge includes:

- maintenance requirements of various organisations and industry trends
- features of integrated management systems within organisations and industry trends:
  - monitoring, adjustment, lubrication, consumables, breakdown maintenance required by typical plant equipment and facilities
  - labour and training requirements for typical maintenance systems
  - maintenance performance indices, such as mean time between failure (MTBF) and overall equipment efficiency (OEE), and relationship to maintenance strategies, business financial objectives and maintenance system design criteria, such as life cycle cost and break-even point
  - maintenance management systems, such as terotechnology
  - maintenance management within ILS
- sources of information, software and hardware required by maintenance systems
- systems thinking in relation to maintenance, failure analysis, problem solving and decision making processes, constraint and contingency management
- compliance requirements of WHS, regulations and standards relevant to maintenance
- risk management requirements and analyses for maintenance of plant, including failure mode effects analyses (FMEA)
- maintainability and reliability related to life cycle costing, system design, cost predictions and break-even analysis
- audit processes for plant, facilities and services, provision of parts and consumables, labour, skills and technical support
- maintenance system data generation and collection, reporting and response processes, data storage and performance analysis for process improvement against performance parameters, such as MTBF and OEE
- manual and automated condition monitoring, testing and analysis

- maintenance system and implementation strategies, including corrective, preventative, predictive, precision, proactive, total productive and reliability centred maintenance
- facilities and service maintenance response systems
- asset categorisation and maintenance scheduling and prioritising
- organisational maintenance safety procedures, such as:
  - risk management procedures
  - WHS committees
  - standard operating procedures
  - safe work methods statements (SWMS)
  - material safety data sheets (MSDS)
  - permits
  - standards related to significant maintenance or plant modifications
- terotechnology
- engineering, plant, facilities and services maintenance requirements
- continuous process improvement
- data generation, analysis, storage and feedback
- reporting techniques and documentation required

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate maintenance systems and processes for safe, cost-effective and sustainable operation.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• investigate sustainability implications of maintenance processes</li> <li>• identify and review features and functions of maintenance and information systems, trends and implementation strategies and software</li> <li>• evaluate safety and risk management, sustainability, asset reliability and maintainability, lean indices, system design parameters, data generation, collection, reporting, storage and analysis, condition monitoring, facilities and services maintenance response systems, asset categorisation, maintenance scheduling and prioritising, and continuous</li> </ul>

	<p>improvement, implementation</p> <ul style="list-style-type: none"> <li>• audit plant, facilities and services, provision of parts and consumables provision, labour, skills and technical support</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>ministerial directives</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular maintenance system</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to</p>

	perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Continuous improvement</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Maintenance systems</b>	<p>Maintenance systems include:</p> <ul style="list-style-type: none"> <li>• breakdown maintenance</li> <li>• preventive maintenance</li> <li>• predictive maintenance (on-condition)</li> <li>• precision maintenance</li> <li>• proactive maintenance</li> <li>• reliability centred maintenance</li> <li>• total productive maintenance</li> </ul>
<b>Lean systems maintenance</b>	Lean maintenance systems aim at maximising machine and process up-time, minimising waste and costs, maintaining quality and delivery and customer service. Maintenance processes and procedures are subject to continuous improvement and are set to complement engineering business objectives
<b>Integrated maintenance</b>	Terotechnology is an integrated maintenance management system

<b>management systems (terotechnology)</b>	<p>combining management, financial, engineering and other practices for cost-effective maintenance of assets, such as plant, equipment and facilities. It involves the design for reliability and maintainability, manufacture, installation, commissioning and eventual write-off and replacement of the assets. Data is collected and analysed to assess the reliability, life cycle costs and productivity of the assets against the design criteria.</p> <p>Reliability relates to the productivity of assets, that is, the maintenance of service or product output (quantities) and its quality within cost parameters. In the context of terotechnology, the cost parameters include life cycle costs</p>
<b>Integrated logistic support (ILS)</b>	<p>ILS is the management and technical process through which supportability and logistic support considerations are integrated into the design and taken into account throughout the life cycle of systems/equipment and by which all elements of logistic support are planned, acquired, tested, and provided in a timely and cost-effective manner. Maintenance systems and schedules are part of this process</p>
<b>Maintenance priority</b>	<p>Assets may be prioritised for maintenance according to different criteria and categories, such as:</p> <ul style="list-style-type: none"> <li>• critical assets: <ul style="list-style-type: none"> <li>• high cost of replacement</li> <li>• unavailability of replacement or spares</li> <li>• failure will or may immediately endanger life and property</li> <li>• essential to quality</li> <li>• high cost of disruption to production or service delivery</li> <li>• failure would require an immediate response</li> </ul> </li> <li>• semi-critical assets: <ul style="list-style-type: none"> <li>• shutdown produces partial loss of capacity</li> <li>• asset is regulated</li> <li>• difficult to repair</li> <li>• alternative asset may be available</li> <li>• some spare parts are stored</li> <li>• medium priority for response</li> </ul> </li> <li>• non-critical: <ul style="list-style-type: none"> <li>• breakdown affects minimal production loss</li> <li>• asset used infrequently</li> <li>• parts readily available</li> <li>• lowest priority attended to as time and resources allow</li> </ul> </li> </ul>
<b>Maintenance activity</b>	<p>An audit of plant, facilities and services may be used to identify maintenance requirements with details listed in the maintenance</p>



<b>audit</b>	<p>database according to different criteria, such as:</p> <ul style="list-style-type: none"> <li>• criticality, locality, machine type and maintenance activities required</li> <li>• skills and techniques required for corrective actions</li> <li>• sources and availability of spares</li> <li>• specialised corrective skills and techniques for specific equipment</li> </ul>
<b>Maintainability</b>	<p>Maintainability refers to the design of product, machines and processes with an objective of reducing maintenance downtime, resources, specialist tools and skills required to maintain reliability. Design techniques may include modular design for ease of replacement, provision of bypass opportunities to isolate the failure for repair while processes continue or provision of substitute equipment</p>
<b>Monitoring and testing</b>	<p>Monitoring and testing may be undertaken for both corrective and proactive and predictive maintenance. Tests may include:</p> <ul style="list-style-type: none"> <li>• manual inspections</li> <li>• instrumented monitoring</li> <li>• lubricant testing (tribology)</li> <li>• lidar (light for atmospheric particle detection)</li> <li>• gas chromatography</li> <li>• mandatory inspections</li> <li>• performance and condition monitoring</li> <li>• radiographic examination for material imperfections</li> <li>• microwave for non-metallic solid or liquid test</li> <li>• camera and scope techniques</li> </ul>
<b>Maintenance system data</b>	<p>Maintenance system data may include:</p> <ul style="list-style-type: none"> <li>• asset ID and plant warranties</li> <li>• procedural documents: <ul style="list-style-type: none"> <li>• monitoring and preventative maintenance schedules</li> <li>• SWMS</li> <li>• MSDS</li> <li>• work permits</li> </ul> </li> <li>• monitoring reports and system measurements</li> <li>• maintenance actions and costs</li> <li>• spares inventory control</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.

# MEM23126A Evaluate industrial robotic applications

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the evaluation of industrial and mobile robotic applications, including loading and positioning capability, accuracy, repeatability, communications requirements, networks and protocols, and effectiveness of integration into automation systems. It includes evaluation of standard industrial robot types as well as mobile robots and other automated elements.

## Application of the Unit

This unit applies to the use of industrial and mobile robotic devices or systems for commercial, industrial, machine and process automation in engineering and related applications.

It is suitable for people working as automation or robotics technicians or paraprofessionals and draftspersons, and those pursuing related technical qualifications and careers.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications
MEM23116A	Evaluate programmable logic controller and related control system component applications
MEM23117A	Evaluate microcontroller applications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish scope of robotics evaluation	1.1	Determine parameters and context of robotics applications to be evaluated
		1.2	Identify stakeholders to be consulted on evaluation
		1.3	Identify software requirements used in the robotic applications
		1.4	Identify relevant compliance requirements of work health and safety (WHS) and regulatory requirements, codes of practice, standards and risk assessment requirements for robotic applications with particular emphasis on automation safety
		1.5	Ensure appropriate support, including licensed electrical, technical and professional assistance, is available
		1.6	Investigate sustainability implications of robotic applications
2	Confirm existing features of robotics applications	2.1	Review features and functions of robotic applications and classify industrial robotic devices
		2.2	Review robots and robotic elements
		2.3	Identify robotic principles and techniques required to evaluate and optimise the processes
		2.4	Identify appropriate analysis techniques, software and software validation techniques

- |   |                               |     |   |
|---|-------------------------------|-----|---|
| 3 | Evaluate robotic applications | 3.1 | Assess robotic hardware, sensors/transducers, signal conditioning, controllers, power interfaces, actuators and interface with the end effectors                |
|   |                               | 3.2 | Assess motion analysis, load capability, accuracy, precision and repeatability  |
|   |                               | 3.3 | Assess system integration, networks, data sharing, control and human machine interfaces   |
|   |                               | 3.4 | Assess software and programming techniques for controllers, distributed control system (DCS), system control and data acquisition (SCADA) and system simulation |
|   |                               | 3.5 | Assess compliance of robot and system with WHS and regulatory requirements, codes of practice, standards and risk management requirements                       |
|   |                               | 3.6 | Apply mock-up and prototyping techniques for robot and subsystem testing  |
|   |                               | 3.7 | Assess sustainability implications of robotic application   |
| 4 | Report results                | 4.1 | Record results of evaluation  |
|   |                               | 4.2 | Provide documentation, such as calculations, specifications, diagrams, computer programs and files, and mock-ups or prototypes                                  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying, reviewing and classifying features and functions of robotic applications and robotic devices, including relevant robotic principles and techniques, analysis techniques and software
- ensuring safe electrical working practice, including use of licensed personnel, where required

- identifying WHS and regulatory requirements, and risk management compliance with particular emphasis on automation safety
- investigating sustainability implications of robotic applications
- determining safety, condition, efficiency and functionality of robotics and associated applications, including:
  - controller functions and programming
  - network and system interfacing
  - compliance with WHS and regulatory requirements
  - automation safety
  - robotic hardware
  - sensors/transducers
  - signal conditioning
  - controllers
  - power interfaces
  - actuators and end effectors
- evaluating robotic motion, including:
  - load capability
  - accuracy
  - repeatability
  - efficiency
- determining efficiency and effectiveness of robotic interfacing, including:
  - system integration and networks
  - data sharing
  - control and human machine interfaces
  - software and programming
  - SCADA or DCS and system simulation
- applying mock-up, prototyping and virtual techniques for robot and subsystem testing
- reporting and documenting results of evaluation, including calculations, specifications, diagrams, computer programs and files, and mock-ups or prototypes

## Required knowledge

Required knowledge includes:

- compliance requirements of WHS and regulatory requirements, codes of practice, standards and risk management requirements for robotic applications
- classifications and applications of industrial robotic devices or systems
- features, mechanisms and components of robots
- advantages and disadvantages of different types of actuators for engineering applications
- types of actuator power interfaces
- end effectors and their applications
- robot sensors, such as:

- contact, proximity and interrupted beam
- distance sensing
- pressure and temperature
- relative and absolute encoders
- vision and smart cameras
- sensor interface/transducer signal conditioning techniques and analog to digital converter (ADC)
- online and offline programming methods
- mechanical, fluid power, electrical, electronic, programming, communications and networking principles and techniques related to robotics
- the role of kinematic and kinetic analysis of robot mechanisms
- analysis of motions, loads, accuracy, precision and repeatability
- situations requiring licensed trade, technical or professional assistance (e.g. actuator power interfacing)
- interfaces for sensors and actuators, such as the use of signal conditioning techniques and ADC, power interfacing and digital to analog converter (DAC), and pulse-width modulation (PWM)
- programming techniques for motion control and load handling with specialist input, such as vision systems, proximity and distance measurement inputs, and variable velocity control which may be implemented using packaged routines
- automation safety in systems and programs, including appropriate use of emergency stop, failsafe design, redundancy, interlocks, guarding and data integrity
- system integration of sensing, control, end effectors and actuators, data requirements, network topology and communication protocols required
- software for simulation, motion analysis, control, DAC and SCADA
- sustainability implications of industrial robotics

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate industrial robotic applications and integration into automation systems. This includes working individually and as part of a team in accordance with organisational procedures.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• identify WHS, regulatory and risk management requirements, and compliance with particular</li> </ul>

	<p>emphasis on automation safety</p> <ul style="list-style-type: none"> <li>investigate sustainability implications of robotic applications</li> <li>identify, review and classify features and functions of robotic applications and robotic devices, robotic principles and techniques, analysis techniques and software</li> <li>evaluate robotic hardware</li> <li>evaluate robotic motion, load capability, accuracy, precision and repeatability</li> <li>evaluate system integration, networking, data sharing, control and human machine interfaces, software and programming</li> <li>apply mock-up, prototyping and virtual techniques for robot and subsystem testing</li> <li>report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence</li> </ul>



	<p>of process.</p> <ul style="list-style-type: none"> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Robotic device or system</b>	Robots are mechanical, programmable self-controlling machines used widely in engineering and related applications where location, work environment, costs, accuracy, quality, repeatability and reliability dictate their use in preference to human or other machines. The robot may be networked so as to serve an automated environment
<b>Industrial robotic applications</b>	Industrial robotic applications vary widely. Examples include: <ul style="list-style-type: none"> <li>• palletising and depalletising robots</li> <li>• welding and cutting robots</li> <li>• packaging robots</li> <li>• transfer robots</li> <li>• interactive remote surgery robots</li> <li>• interactive nuclear fuel cell robots</li> </ul>
<b>Mobile robotic applications</b>	Mobile robotic applications may include: <ul style="list-style-type: none"> <li>• military robots, including land mine detection and improvised explosive demolition</li> <li>• police bomb detection robots</li> <li>• automated guidance vehicles</li> </ul>
<b>Review features and functions of robotic</b>	Features and functions may be assessed by analysis of specifications and drawings, 'reverse engineering' of robotic

<b>applications</b>	applications and performance analysis using simulation and dynamic performance software. The review may include motion control but does not require validation of dynamic stability which is included in other units and dependant on solution of differential equations
<b>Sensor and actuator interfacing techniques</b>	Sensor and actuator interfacing techniques include the use of: <ul style="list-style-type: none"> <li>• signal conditioning techniques and ADC, power interfacing and DAC and PWM</li> </ul>
<b>Controller programming techniques for motion control and load handling</b>	Controller programming techniques may include the use of various motion pathway methods, including: <ul style="list-style-type: none"> <li>• 'teach' mode or coordinate and path programming</li> <li>• use of variable velocity algorithms</li> <li>• provision for input variables, such as contact, proximity, measured distance or load and vision, pressure and temperature, and open and closed loop actuator control</li> </ul>
<b>Sustainability</b>	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Analysis</b>	Analysis may include: <ul style="list-style-type: none"> <li>• static and dynamic analysis of loads</li> <li>• the stresses and deformations resulting</li> <li>• graphical and mathematical methods and software options</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	WHS, regulatory requirements and enterprise procedures may include: <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>

<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular robotic application
<b>Automation safety</b>	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks, guarding and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"><li>• licensed electrical tradespersons</li><li>• technical support and advice relating to elements which have intrinsic dangers, such as:<ul style="list-style-type: none"><li>• high pressure</li><li>• energised fluid vessels</li><li>• high temperatures and heat energy capacity</li><li>• wiring with high current control voltages above extra low voltage</li></ul></li><li>• professional support for technologies, such as:<ul style="list-style-type: none"><li>• specialist electric motor drives and controllers</li><li>• specialist materials, plastics, metal alloys and nano materials</li><li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li></ul></li></ul>

## Unit Sector(s)

### Competency field

### Unit sector

## Custom Content Section

Not applicable.

# **MEM23129A Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the evaluation of thermal load estimates for a commercial refrigeration system and a multiple zone commercial/industrial building. It includes work health and safety (WHS) and related safety compliance requirements, and system evaluation, including the use of software and validation, thermodynamic concepts and laws.

## **Application of the Unit**

This unit applies to individuals conducting thermal load evaluations for heating, ventilation, air conditioning and refrigeration (HVAC/R) systems in buildings and engineering, commercial refrigeration systems and related installations. It is suitable for people working as technicians, system designers, draftspersons, maintainers and those pursuing careers and qualifications in engineering or related disciplines.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Determine scope of evaluation of thermal loads and HVAC/R systems | 1.1 | Establish type, location and scope of HVAC/R systems, building and refrigerated enclosures from plans, data sheets, specifications and site inspections |
|   |   | 1.2 | Identify stakeholders to be consulted during evaluation   |
|   |   | 1.3 | Establish software and software techniques required for evaluation analysis   |
|   |   | 1.4 | Determine WHS, regulatory and environmental requirements relevant to evaluation   |
|   |   | 1.5 | Investigate sustainability implications of HVAC/R and building management systems   |
|   |   |     |   |
| 2 | Prepare for thermal loads and HVAC/R systems evaluation           | 2.1 | Review thermal load analysis techniques for multiple zone commercial or industrial buildings, including use of tabulations and computer software        |
|   |   | 2.2 | Identify sources of heat gains for building   |
|   |   | 2.3 | Review room sensible and latent heat, including peak values   |
|   |   | 2.4 | Review thermal load analysis techniques for commercial refrigeration systems, including use of tabulations and computer software                        |
|   |   | 2.5 | Identify heat load sources for refrigerated enclosures or zones   |
|   |   | 2.6 | Determine tools, equipment, testing devices and materials required for evaluation   |
|   |   | 2.7 | Determine required measurements and measurement techniques  |

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- |   |   |     |   |
|---|---|-----|---|
|   |   | 2.8 | Calibrate, set up, and test measurement equipment and procedures  |
|   |   | 2.9 | Identify appropriate analysis techniques, analysis and simulation software and software validation techniques   |
| 3 | Evaluate thermal loads and HVAC/R systems | 3.1 | Evaluate thermal load for a commercial refrigeration system   |
|   |   | 3.2 | Evaluate thermal load for a multiple zone commercial or industrial building   |
|   |   | 3.3 | Evaluate the effects of internal and external parameter changes on refrigeration system performance   |
|   |   | 3.4 | Evaluate thermal performance of a building and options for design improvements  |
|   |   | 3.5 | Evaluate building to identify and mitigate high thermal loads   |
|   |   | 3.6 | Evaluate performance of refrigeration and air conditioning system against specifications and determine optimum operational settings   |
|   |   | 3.7 | Evaluate equipment size, including coil and air handling unit capacities for constant and variable volume systems, and central refrigeration and boiler capacities  |
|   |   | 3.8 | Evaluate and validate software for refrigeration and building thermal performance analysis and system simulation  |
| 4 | Report results                            | 4.1 | Record results of evaluation, including recommendations for design and system setting optimisation  |
|   |   | 4.2 | Provide relevant documentation, such as thermal load audits, calculations for heating and cooling loads, building and refrigeration layouts, heating and cooling system and component arrangements, and system improvement diagrams |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining HVAC/R system parameters from plans, specifications and site inspections
- reviewing features and functions of HVAC/R system components
- investigating sustainability implications of HVAC/R systems
- identifying relevant thermodynamic principles and techniques
- testing and measuring system and component performance parameters
- evaluating system thermal loads and relationship to, and implications for, component sizes and system performance
- selecting and using appropriate calculations, techniques and software for analysis and simulations
- validating software and software techniques required for thermal load evaluations
- reporting and documenting processes, results and recommendations

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- current options and trends in performance analysis software, including underpinning program techniques
- thermal load measuring equipment and test apparatus
- sustainability implications of HVAC systems, including consideration of energy sources and energy efficiency
- thermodynamic principles required by thermal loading analysis and HVAC/R management systems
- thermodynamic concepts related to HVAC/R:
  - properties, process and state
  - mass, conservation of mass, specific volume and density, specific volume, relative density, force, weight, pressure, temperature, Zeroth law, absolute scales and International System of Units (SI) units
  - systems, cycles and steady state
- energy forms
- effects of heating of solids and liquids
- heat transfer, conduction, convection and radiation:
  - property tables for conductivity, convection and radiation coefficients
  - Fourier law of conduction and conductivity of materials

- convection:
  - mechanism of convection
  - convection heat transfer coefficient and factors affecting the coefficient
  - fluid flow characteristics (geometry of convection surfaces, natural and forced convection and flow regime)
  - units, kinematic viscosity and dynamic viscosity
  - convective heat transfer coefficients for conduit and annular flow, hydraulic diameter
  - heat exchangers (types, efficiency and measurements)
- radiators:
  - emission, absorption and reflection (properties and measurements)
  - Wien's displacement law
  - Kirchhoff's law
- solar energy, heating and power generation
- radiant energy on surfaces  $G_s = G_o \tau^s$
- variations, such as Azimuth and zenith angles, path length, cloud cover and water vapour, and shade factors for windows
- combined heat transfer
- conduction plus convection, heat exchangers using air and water as transfer mediums
- conduction, convection and radiation (qualitative)
- cooling fins
- heat flow, electrical analogy, graphical solution techniques and qualitative understanding of numerical methods
- vapour compression refrigeration:
  - vapour-compression cycle for refrigeration
  - system components, including throttling valves and capillary tubes as throttling devices
  - performance criteria for refrigeration system evaluation
  - types of refrigerant
  - refrigerant properties and p-h diagrams:
    - ideal vapour compression cycle on the p-h diagram
    - energy balance and heat transfers in compressor, evaporator and condenser
    - variation of actual cycles from the ideal
    - vapour-compression cycle with suction superheating, liquid sub-cooling and pressure drop in system components
- mechanical components of vapour compression (refrigeration and HVAC systems)
- refrigeration enclosures, cabinets, cold rooms and freezer rooms
- factors affecting refrigeration heat transfer
- building thermal performance survey procedures
- standard thermal values in relation to a commercial/industrial building
- equipment size for constant and variable volume systems and central refrigeration and boiler capacities



- thermal properties of buildings and building materials
- people loads
- cost implications of air conditioning and heating designs
- heat loads
- thermal lag
- occupant comfort and safety factors

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate the thermal loads for a commercial refrigeration system and for a multiple zone commercial or industrial building.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine HVAC/R system parameters</li> <li>• investigate sustainability implications of HVAC/R systems</li> <li>• identify relevant thermodynamic principles and techniques for particular HVAC/R system thermal load evaluations</li> <li>• review features and functions of HVAC/R systems and components</li> <li>• test and measure HVAC/R systems and component performance parameters</li> <li>• evaluate system and component performance with tabulated and software generated data</li> <li>• apply and validate software for analysis and simulation</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical</li> </ul>

	resources should include equipment modified for people with disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>meeting all regulatory requirements</li> <li>conforming to all industry covenants, protocols and best practice guides</li> <li>minimising ecological and environmental footprint of process, plant and product</li> <li>maximising economic benefit of process plant and product to the organisation and the community</li> <li>minimising the negative WHS impact on employees, community and customer</li> </ul>
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<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task</p>
<b>Building heat gains</b>	<p>Building heat gains are affected by:</p> <ul style="list-style-type: none"> <li>• external, internal and system heat gains</li> <li>• U values and infiltration rates for various wall and roof constructions</li> <li>• sun, Azimuth and altitude angles, and overall shade factors for various windows</li> </ul>
<b>Commercial refrigeration cabinets</b>	<p>Characteristics of commercial refrigeration cabinets include:</p> <ul style="list-style-type: none"> <li>• defrost systems/heat</li> <li>• temperature control</li> <li>• air flows (refrigeration)</li> <li>• air screens (refrigerated and ambient store)</li> <li>• types of evaporation</li> <li>• lighting</li> </ul>

<b>Miscellaneous heat</b>	Miscellaneous heat loads on refrigeration systems include: <ul style="list-style-type: none"><li>• electrical load</li><li>• human load</li><li>• defrost load</li><li>• machinery load</li></ul>
<b>Relevant documentation</b>	Relevant documentation may include: <ul style="list-style-type: none"><li>• thermal load audits</li><li>• calculations for heating and cooling loads</li><li>• building and refrigeration layouts</li><li>• heating and cooling system and component arrangements</li><li>• system improvement diagrams</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23130A Coordinate servicing and fault-finding of HVAC/R control systems**

## **Modification History**

Release 1 (MEM05v9)

## **Unit Descriptor**

This unit of competency covers the coordination of servicing and fault-finding of heating, ventilation, air conditioning and refrigeration (HVAC/R) environment control systems. The control system may be a part of a building management system. It includes work health and safety (WHS) and related safety compliance requirements, performance analysis software and validation, and related thermodynamic concepts and laws.

## **Application of the Unit**

This unit applies to technicians who are required to coordinate the servicing and fault-finding of HVAC/R control systems. This includes undertaking required technical analyses and coordinating and supervising tradespersons or other technicians. The extent of individual and joint work may vary according to the size of the HVAC/R system. The unit may also apply to system managers, designers and draftspersons, and others who are required to evaluate the performance of HVAC/R control systems.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |   |
|---|---|---|
| 1 | Prepare for HVAC/R analysis and service task            | 1.1 Establish type, location and scope of control systems for HVAC/R plant  |
|   |   | 1.2 Identify stakeholders to be consulted during analysis and service   |
|   |   | 1.3 Lead review of functions and features of HVAC/R system  |
|   |   | 1.4 Establish software and software techniques required for evaluation  |
|   |   | 1.5 Identify relevant WHS, regulatory and environmental requirements  |
|   |   | 1.6 Investigate sustainability implications of HVAC/R control and energy management systems   |
|   |   |   |
| 2 | Coordinate review and analysis of HVAC/R control system | 2.1 Review passive characteristics, heat loads and energy requirements for the HVAC/R system  |
|   |   | 2.2 Review energy options, tariffs, system and component consumption against benchmarks and comparative tariffs   |
|   |   | 2.3 Confirm scope of control system hardware, including controllers, analog and digital Input/Output (I/O), interfaces and actuators, including electrical, electronic, pneumatic and hydraulic devices |
|   |   | 2.4 Review, map and monitor HVAC/R control system, protocols and topology, system function, control settings, I/O, and major system hardware components and energy requirements                         |
|   |   | 2.5 Identify building management system control system software and programming techniques  |

- 2.6 Supervise selection of tools, equipment, testing devices and materials required for service and fault-finding
  - 2.7 Determine required measurements and measurement techniques
  - 2.8 Supervise calibrate, set up, and test measurement equipment and procedures
  - 2.9 Identify appropriate analysis techniques, analysis and simulation software and software validation techniques
- 3 Coordinate servicing, fault-finding and optimising of HVAC/R control systems
  - 3.1 Supervise measuring of the performance of the control system in maintaining specified environmental conditions
  - 3.2 Adjusted HVAC/R system to specification according to specifications and enterprise procedures
  - 3.3 Ensure isolation, repair or replacement of components not performing to specification
  - 3.4 Validate control programs and software for system performance and simulation
  - 3.5 Supervise testing or measuring on an electrically live system
  - 3.6 Ensure compliance with WHS, regulatory, environmental and risk management requirements
  - 3.7 Optimise the control system for economic and efficient operation through daily, seasonal and annual cycles
  - 3.8 Develop control diagram and record settings for optimal system performance
- 4 Report results
  - 4.1 Record results, including rectification or improvement recommendations
  - 4.2 Provide report and supporting documentation, such as building thermal and control system audits, energy costing, and efficiency evaluations, control system map and signal diagrams, control programs, system analysis and simulation files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting drawings, diagrams, manuals and design information to determine HVAC/R control system layout, components and functions
- identifying WHS and other regulatory requirements
- coordinating the work of others in HVAC/R servicing and fault-finding, including allocating tasks and confirming results
- communicating with clients, stakeholders and technical experts
- identifying sustainability implications of HVAC/R control systems
- selecting appropriate HVAC/R analysis and simulation software and validation techniques
- reviewing control systems techniques, hardware and software taking into account thermal loads, energy options, tariffs, consumption, benchmarks and comparative tariffs
- mapping and monitoring control system, function, settings, I/O, and hardware and energy requirements
- optimising the energy management system
- measuring control system performance and developing optimal control diagram and settings
- documenting and reporting evaluation results, including efficiency evaluations, maps and diagrams, programs, analysis and simulation files and conclusions

### Required knowledge

Required knowledge includes:

- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- trends in HVAC/R system design, installation, operation and maintenance, including integration with energy management systems
- current options and trends in performance analysis software, including underpinning program techniques
- sustainability implications of HVAC/R systems control and energy management systems
- building management systems features and functions related to HVAC/R and integration with other features, such as:
  - lighting, alarms and security
  - multi-zone operation
  - operating modes, such as occupied, unoccupied, morning warm-up, and night-time setback
- features, components, functions, protocols and topology of HVAC/R control systems,



including:

- protocols and topology
- control settings
- I/O devices and techniques
- software and programming techniques
- proportional-integral-derivative (PID) controller functions in HVAC/R control systems
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators
- HVAC/R principles and techniques related to energy distribution and consumption
- passive characteristics and heat load on the system under control
- daily, seasonal and annual HVAC/R load cycles
- sources of technical and professional assistance for engineering specialisations
- energy options, unit tariffs, system and component consumption, benchmarks for energy costs and comparative tariffs
- testing and measuring devices and materials and their calibration, set-up, test and use
- analysis techniques, including use of analysis and simulation software and software validation techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to coordinate the servicing, fault-finding and optimisation of HVAC/R control systems. This includes working individually or as part of a team on analysis and optimisation technical tasks.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"> <li>• communicate HVAC/R servicing and fault-finding tasks and requirements to others</li> <li>• identify relevant WHS, other regulatory requirements, standards and codes</li> <li>• investigate sustainability implications of HVAC/R control systems</li> <li>• assess HVAC/R control system and hardware, including building management system control systems</li> <li>• use appropriate analysis and simulation software and validation techniques</li> <li>• review thermal loads, hardware, energy options, tariffs,</li> </ul>

	<p>consumption, benchmarks and comparative tariffs</p> <ul style="list-style-type: none"> <li>• map and monitor control system, I/O, hardware and energy use</li> <li>• optimise HVAC/R control system for seasonal and load cycles</li> <li>• measure control system performance</li> <li>• develop optimal control diagram and settings</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may

be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>HVAC/R control system</b>	<p>HVAC/R control systems hardware and environmental requirements may include control systems in:</p> <ul style="list-style-type: none"> <li>• industrial refrigeration systems</li> <li>• commercial refrigeration systems</li> <li>• hydronic systems</li> <li>• automatic controls</li> <li>• food storage technology</li> </ul>
<b>Building management system HVAC/R control systems</b>	<p>Building management system HVAC/R control systems may include:</p> <ul style="list-style-type: none"> <li>• human-machine interfaces (HMI)</li> <li>• web servers, network topology and bus systems</li> <li>• protocols</li> <li>• system or network controllers</li> <li>• programmable logic controllers (PLCs)</li> <li>• terminal unit controllers for major plant components, such as boilers and HVAC/R central plant air handlers, chilled and hot water valves, air dampers, supply fans and lighting</li> <li>• analog and digital I/O, interfaces and actuators, including electrical, electronic, pneumatic and hydraulic devices</li> <li>• remote control systems, including ethernet options</li> <li>• interfaces with other controlled systems, such as fire, security, and lighting</li> </ul>
<b>Analog or digital I/O</b>	<p>Analog or digital I/O may include:</p> <ul style="list-style-type: none"> <li>• inputs, such as temperatures, humidity, pressure, current flow and air flow</li> <li>• analog inputs, including temperature, humidity and pressure sensors transmitting 4–20 mA or 1–10 V signals</li> <li>• digital inputs, such as volt-free switches or relays or 24 VDC/AC and pneumatic/electronic interfaces</li> <li>• analog outputs, including variable frequency speed drives, hot or chilled water proportional valves responding to a set-point difference or a damper setting</li> <li>• digital outputs to switch lights, valves or motor relays on or off, including alarms</li> <li>• special I/O include: <ul style="list-style-type: none"> <li>• alarms for limiting condition or status indication, such as the monitoring of carbon monoxide levels or low motor current</li> <li>• pneumatic and hydraulic sensor and actuator interfaces</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p>

	<ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• switch boards, electric motors and wiring with high current and voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task</p>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

# **MEM23131A Evaluate rapid prototyping applications**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the evaluation of rapid prototyping applications using additive processes, spray deposition and casting processes, rapid machining, cutting and welding. It requires consideration of product manufacturability, materials, resources and skills, plant and tooling requirements systems and processes, strength, form, fit, function, lead time and sustainability.

## **Application of the Unit**

This unit applies to rapid prototyping for engineering-related applications. It is suitable for people working as manufacturing or maintenance technicians, designers and draftspersons, and those pursuing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish scope of rapid prototyping application	1.1	Identify technology, including software, used in rapid prototyping application
		1.2	Identify purpose and product of rapid prototyping application
		1.3	Confirm stakeholders to be consulted as part of evaluation
		1.4	Confirm that appropriate support, including technical and professional assistance, is available
		1.5	Determine relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Identify principles and techniques required for evaluation of rapid prototyping application	2.1	Determine principles and techniques required to evaluate and optimise the rapid prototyping applications
		2.2	Select appropriate analysis and development software and software validation techniques
3	Evaluate rapid prototyping application	3.1	Assess WHS and regulatory compliance requirements and risk management practices of rapid prototyping processes
		3.2	Assess effectiveness of software for product design, process analysis and optimisation
		3.3	Determine suitability of facilities, services, plant and tooling for rapid prototyping processes
		3.4	Assess materials against specifications in design and suitability for rapid prototyping processes
		3.5	Review prototypes for compliance with specifications and process efficiency,
		3.6	Review rapid prototyping cost-effectiveness, including break-even and comparative costing relative to

		alternatives
	3.7	Review labour and skills requirement of rapid prototyping application
	3.8	Investigate sustainability implications of rapid prototyping application
	3.9	Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management
4	Report results	
	4.1	Record results of evaluation
	4.2	Provide documentation, such as drawings, calculations, product and process analysis, and computer-aided design (CAD) files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining technologies, parameters and context of rapid prototyping applications
- investigating sustainability implications of rapid prototyping applications
- reviewing features and functions of rapid prototyping applications
- identifying rapid prototyping principles and techniques, analysis techniques and software
- identifying relevant WHS, regulatory and risk management compliance requirements for rapid prototyping applications
- assessing software, facilities, services, plant and tooling, and materials
- analysing labour and skills distribution requirements, degree of automation and competitiveness, costs and break-even
- evaluating rapid prototyping against alternative methods and technologies
- reporting and documenting results of scoping, principles and techniques identification and evaluation of products and processes, product and process analysis, and CAD files

### Required knowledge

Required knowledge includes:



- range, features and applications of rapid prototyping processes, including:
  - digitisers and reverse engineering processes
  - selective laser sintering (SLS)
  - fused deposition modelling (FDM)
  - stereolithography (SLA)
  - laminated object manufacturing (LOM)
  - electron beam melting (EBM)
  - 3-D printing (3-DP)
  - solid freeform fabrication
  - sprayed metal deposition
  - direct metal deposition (DMD)
  - casting (patternless and rapid pattern processes)
  - vacuum forming
  - rapid machining (subtractive) options
  - rapid cutting options, such as computer driven gas and laser cutting
  - robot and auto welding
- common applications for rapid prototyping, including:
  - concept modelling
  - multiple design iterations at low cost
  - form, fit and function testing prior to committing to tooling
  - market design verification prior to mass production
  - masters for vacuum forming and investment casting
  - one piece thermoplastic jigs and fixtures
  - one-off full strength plastic, cast, direct deposited metal or sprayed metal components
- sources of technical and professional assistance
- sustainability implications of rapid prototyping applications and processes
- rapid prototyping principles, techniques and software
- WHS, regulatory and risk management requirements relevant to rapid prototyping applications
- facilities, services, plant and tooling required for rapid prototyping applications
- materials used in additive 'printing' processes
- materials for sprayed metal deposition
- materials for rapid casting
- other materials, including:
  - thermoplastics for vacuum forming
  - materials for rapid machining and fabrication
- component design processes and CAD techniques relevant to rapid prototyping processes and applications, including:
  - size limitations
  - combining components

- digitising
- reverse engineering
- labour and skills requirements relevant to rapid prototyping
- systems thinking, continuous improvement, and constraint and contingency management techniques
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate rapid prototyping applications for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• evaluate suitability of a rapid prototyping application against alternative processes</li> <li>• review features and functions of rapid prototyping processes</li> <li>• select appropriate rapid prototyping principles and techniques, analysis techniques and software</li> <li>• determine WHS and regulatory requirements, risk management and organisational procedures</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where</li> </ul>

	applicable, physical resources should include equipment modified for people with disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Rapid prototyping applications</b>	<p>Rapid prototyping applications are typically applications with either one-off or small to medium quantities. Rapid prototypes are typically developed for:</p> <ul style="list-style-type: none"> <li>concept modelling</li> <li>multiple design iterations at low cost</li> <li>form, fit and function testing prior to committing to tooling</li> <li>market design verification prior to mass production</li> </ul>
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	<ul style="list-style-type: none"> <li>• masters for vacuum forming and investment casting</li> <li>• one piece thermoplastic jigs and fixtures</li> <li>• one-off full strength plastic, cast, direct deposited metal or sprayed metal components</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid prototyping application</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and</li> </ul>

	<p>product to the organisation and the community</p> <ul style="list-style-type: none"> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## **Custom Content Section**

Not applicable.

# **MEM23132A Evaluate rapid manufacturing processes**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers evaluation of rapid manufacturing based on additive, spray deposition and casting processes and includes evaluating the processes for their applicability, market competitiveness and sustainability. The unit requires consideration of product manufacturability, materials, systems and processes maintainability, plant and tooling requirements.

## **Application of the Unit**

This unit applies technical evaluations of rapid manufacturing processes. It is suitable for people working as technicians, designers and draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish scope of rapid manufacturing processes and application	1.1	Identify technologies, including software, used or proposed in rapid manufacturing application
		1.2	Confirm stakeholders to be consulted as part of evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify market context for rapid manufacturing product
		1.5	Determine relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Identify principles and techniques required for evaluation of rapid manufacturing application	2.1	Determine principles and techniques required to evaluate and optimise the rapid manufacturing application
		2.2	Select appropriate analysis and development software and software validation techniques
3	Evaluate rapid manufacturing processes	3.1	Assess WHS and regulatory compliance requirements and risk management practices of rapid manufacturing processes
		3.2	Assess effectiveness of software used for product design, rapid manufacturing process control and process optimisation
		3.3	Review suitability of facilities, services, plant and tooling for rapid manufacturing processes
		3.4	Assess products and rapid manufacturing processes for sustainability
		3.5	Assess materials against specifications in design and suitability for rapid manufacturing processes
		3.6	Assess process for appropriate degree of automation and other technical efficiency aspects



- |   |                |  |
|---|----------------|--|
|   | 3.7            | Review rapid manufacturing application for competitiveness, including supply chain performance, costs, break-even and comparative performance of alternative manufacturing methods |
|   | 3.8            | Review labour and skill requirements   |
|   | 3.9            | Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management   |
| 4 | Report results |  |
|   | 4.1            | Record results of evaluation   |
|   | 4.2            | Provide documentation, such as drawings, calculations, product and process analysis, and computer-aided design (CAD) files   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining technologies, parameters and context of rapid manufacturing applications
- investigating sustainability implications of rapid manufacturing processes and associated products
- reviewing features and functions of rapid manufacturing processes, including assessing:
  - compliance of rapid manufactured product with design specifications
  - suitability of materials and equipment used in a rapid manufacturing process
  - efficiency of selected rapid manufacturing processes against other manufacturing processes, including cost-benefit analysis of alternative methods of rapid manufacturing, where applicable
  - integration of rapid manufacturing processes with manufacturing practice systems, such as lean manufacturing
  - skill and training requirements of the applicable rapid manufacturing processes
- identifying and evaluating rapid manufacturing control systems and software
- selecting and using appropriate analysis techniques and software for evaluation of rapid manufacturing processes
- identifying relevant WHS, regulatory and risk management compliance requirements for rapid manufacturing applications

- assessing software, facilities, services, plant and tooling, and materials for suitability to rapid manufacturing applications
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of rapid manufacturing processes
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

## Required knowledge

Required knowledge includes:

- range, features and applications of rapid manufacturing processes, including:
  - digitisers and reverse engineering processes
  - selective laser sintering (SLS)
  - fused deposition modeling (FDM)
  - stereolithography (SLA)
  - laminated object manufacturing (LOM)
  - electron beam melting (EBM)
  - 3-D printing (3-DP)
  - solid freeform fabrication
  - sprayed metal deposition
  - direct metal deposition (DMD)
  - casting (patternless and rapid pattern processes)
  - vacuum forming
- sources of support, including technical and professional assistance
- sustainability implications of rapid manufacturing processes
- WHS, regulatory and risk management requirements relevant to rapid manufacturing applications
- relationship between process and product in rapid manufacturing technologies, for example:
  - using printing or SLA processes in low strength paper or plastic applications
  - higher component strength applications in plastics or sintered metals
  - applications using tool steels, brass, stainless steel, carbon steel and aluminum alloy, such as metal spray deposition or lost wax for cast products
- materials for additive 'printing' processes
- materials for sprayed metal deposition
- materials for rapid casting
- other materials (e.g. thermoplastics for vacuum forming)
- labour and skills requirements for rapid manufacturing processes
- systems thinking, continuous improvement, and constraint and contingency management
- CAD functions, features and techniques related to rapid manufacturing, including relevant file formats

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate rapid manufacturing applications for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• review technologies, including software, used in rapid manufacturing applications</li> <li>• evaluate rapid manufacturing processes for efficiency and cost-benefit against alternative manufacturing techniques</li> <li>• select appropriate analysis principles and techniques and software</li> <li>• identify and assess compliance against relevant WHS and regulatory requirements, risk management and organisational procedures</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure</li> </ul>

	<p>correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Rapid manufacturing applications</b>	<p>Rapid manufacturing applications can be found in most industries with the selection of a rapid manufacturing process depending on the suitability of the product and materials for available rapid manufacturing equipment and cost-benefit analysis against traditional manufacturing alternatives. Examples of rapid manufactured items may include:</p> <ul style="list-style-type: none"> <li>• medical and biomedical prosthetics and implants</li> <li>• custom musical instruments</li> <li>• jewellery</li> <li>• consumer products</li> <li>• toys</li> <li>• any small to medium quantity item, particularly involving high set-up cost associated with using alternative or traditional methods</li> </ul>
<b>Context of manufacturing processes</b>	<p>The context of manufacturing operations includes consideration of:</p> <ul style="list-style-type: none"> <li>• global competitive markets</li> <li>• product and process sustainability</li> <li>• lean systems</li> <li>• product manufacturability</li> <li>• system maintainability</li> </ul>

	<ul style="list-style-type: none"> <li>• facilities, services, plant and tooling requirements</li> <li>• supply chains</li> <li>• material and product flow</li> <li>• transfer operations</li> <li>• process control</li> <li>• labour requirements and skills distribution</li> <li>• information flow</li> <li>• systems thinking, continuous improvement, and constraint and contingency management</li> <li>• WHS and regulatory requirements and risk management</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid manufacturing process</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> </ul>

	<ul style="list-style-type: none"> <li>conforming to all industry covenants, protocols and best practice guides</li> <li>minimising ecological and environmental footprint of process, plant and product</li> <li>maximising economic benefit of process plant and product to the organisation and the community</li> <li>minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>balanced scorecard</li> <li>current and future state mapping</li> <li>measuring performance against benchmarks</li> <li>process improvement, problem solving and decision making</li> <li>data management, generation, recording, analysing, storing and use of software</li> <li>training for improvement systems participation</li> <li>technical training</li> </ul>
<b>Manage constraints and contingencies</b>	<p>Contingencies arising during operations or improvement projects are responded to in the context of constraints. Contingencies may threaten operations or improvement projects and planning for contingencies may be essential to maintain resources, skilled labour and schedules. Each contingency will have constraints on possible solutions. These may be:</p> <ul style="list-style-type: none"> <li>financial, organisational, procedural or cultural</li> <li>physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>

<b>Process competitiveness</b>	Competitive or lean processes uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness
<b>Automation</b>	Automation options range from manual operations with manual information generation, handling, analysis and storage to islands of automation, supported by manual interfaces with some electronic information processing, to systems with major automation and networked data handling
<b>Labour requirements and skills distribution</b>	Globally competitive manufacturing processes require well trained employees for flexibility of deployment options and minimisation of labour waste. Continuous improvement requires continuous training to match skills to process improvements and developments. Modern manufacturing processes require proactive maintenance participation and skills development

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23133A Evaluate rapid tooling applications**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers evaluation of rapid tooling applications for their suitability for purpose. It includes additive processes, spray deposition and casting processes, and rapid machining, cutting and welding. It requires consideration of product manufacturability, materials, resources and skills, plant and tooling requirements systems and processes, strength, form, fit, function, lead time and sustainability.

## **Application of the Unit**

This unit applies to rapid tooling applications. It is suitable for people working as manufacturing or maintenance technicians, designers and draftspersons, and those pursuing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.



## Elements and Performance Criteria

1	Determine scope of rapid tooling application	1.1	Identify technologies, including software, used or proposed in rapid tooling application
		1.2	Confirm stakeholders to be consulted on evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify market context for rapid manufacturing product
		1.5	Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Identify principles and techniques required for evaluation of rapid tooling application	2.1	Determine principles and techniques required to evaluate and optimise rapid tooling process and application
		2.2	Select appropriate analysis and development software and software validation techniques
3	Evaluate rapid tooling application	3.1	Evaluate WHS and regulatory compliance requirements and risk management practices of rapid tooling processes
		3.2	Assess tooling and rapid tooling processes for sustainability
		3.3	Assess effectiveness of software used for tool design, rapid tooling process control and process optimisation
		3.4	Review suitability of facilities, services and plant for rapid tooling processes
		3.5	Evaluate suitability of materials used in rapid tooling process
		3.6	Evaluate tooling and process effectiveness, costs, break-even, and comparative costing relative to alternatives
		3.7	Review labour and skill requirements of rapid tooling

		process
	3.8	Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management
4	Report results	4.1 Record results of evaluation
		4.2 Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining technologies, parameters and context of tooling applications
- investigating sustainability implications of tooling and rapid tooling processes
- reviewing features and functions of rapid tooling processes, including assessing:
  - compliance of tooling with tool design
  - suitability of materials and equipment used in a rapid tooling process
  - efficiency of selected rapid tooling processes against other tool manufacturing processes, including cost-benefit analysis of alternative methods of rapid tooling, where applicable
  - skill and training requirements of the applicable rapid tooling processes
- identifying and evaluating rapid tooling control systems and software
- selecting and using appropriate analysis techniques and software for evaluation of rapid tooling processes
- identifying relevant WHS, regulatory and risk management compliance requirements for rapid tooling applications
- assessing software, facilities, services, plant and materials for suitability to rapid tooling applications
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of rapid tooling processes
- reporting and documenting results of scoping, principles and techniques identification and evaluation of systems, layouts, programs and flow charts

### Required knowledge

Required knowledge includes:

- features and functions of additive rapid tooling processes, including:
  - 3-D printing (3-DP)
  - stereolithography (SLA)
  - selective laser sintering (SLS)
  - electron beam melting (EBM)
  - fused deposition modelling (FDM) and direct metal deposition (DMD)
  - casting (patternless and rapid pattern processes)
  - vacuum forming
  - rapid prototyping machines
  - metal spray deposition
- materials for additive 'printing' processes
- materials for sprayed metal deposition
- materials for rapid casting
- other materials, including:
  - thermoplastics for vacuum forming
  - materials for rapid machining and fabrication
- tool features and functions, such as:
  - functional requirements
  - punches and dies
  - cavity shapes
  - clearances and drafts
  - heat treatment options
  - surface finishing
  - tool component assembly, location and security
- CAD design and modelling techniques to suit rapid tooling materials, machines and processes
- sustainability implications of rapid tooling and rapid processes
- typical advantages and disadvantages of rapid tooling compared to alternative or traditional system costings
- sources of support, including technical and professional assistance
- rapid tooling software principles and applications
- WHS, regulatory and risk management requirements
- typical facilities, services, plant required for rapid tooling
- systems thinking, continuous improvement, constraint and contingency management, and comparative supply chain performance
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate rapid tooling applications for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• review features and functions of rapid tooling processes and the fitness for purpose of tooling produced</li> <li>• evaluate rapid tooling processes for efficiency and cost-benefit against alternative tool manufacturing techniques</li> <li>• select appropriate analysis principles, techniques and software</li> <li>• identify and assess compliance against relevant WHS and regulatory requirements, risk management and organisational procedures</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks</li> </ul>

	<p>and include questioning on underpinning knowledge to ensure correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Rapid tooling applications</b>	<p>Rapid tooling applications are typically used in:</p> <ul style="list-style-type: none"> <li>• small to medium volumes of product using sintered tools</li> <li>• large volumes of product using sprayed metal tools</li> <li>• situations where one-off tooling requirements are common and speed of tooling manufacture is important</li> </ul>
<b>Context of rapid tooling processes</b>	<p>The context of rapid tooling processes includes consideration of:</p> <ul style="list-style-type: none"> <li>• global competitive markets</li> <li>• product and process sustainability</li> <li>• lean systems</li> <li>• product manufacturability</li> <li>• facilities, services, plant and tooling requirements</li> <li>• supply chains</li> <li>• material, transfer operations</li> <li>• process control</li> <li>• labour requirements and skills distribution</li> <li>• information flow</li> <li>• systems thinking, continuous improvement, and constraint and contingency management</li> </ul>

	<ul style="list-style-type: none"> <li>WHS, regulatory requirements and risk management</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid tooling application
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>meeting all regulatory requirements</li> <li>conforming to all industry covenants, protocols and best practice guides</li> <li>minimising ecological and environmental footprint of process, plant and product</li> <li>maximising economic benefit of process plant and product to the organisation and the community</li> <li>minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	Systems thinking refers to the conduct of engineering work in a

	<p>manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.



# MEM23134A Evaluate jigs and fixtures

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the evaluation of design features and functions of jigs, fixtures, templates and gauges for the machining, fabrication, assembly and welding of manufactured products.

## Application of the Unit

This unit applies to evaluating the safety and suitability of proposed or existing jigs, fixtures, templates and gauges for the manufacture of components for engineering or related applications. It is suitable for people working as tool designers and maintenance technicians or paraprofessionals and draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of evaluation	1.1	Identify purpose and extent of use of jigs, fixtures, templates and gauges to be evaluated
		1.2	Confirm stakeholders to be consulted on evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Prepare for evaluation	2.1	Identify principles and techniques required to evaluate and optimise selected jigs, fixtures, templates and gauges and their use in related manufacturing processes
		2.2	Select appropriate analysis and development software and software validation techniques
		2.3	Consult with relevant tradespersons or contractors on any specific requirements or constraints for manufacture, supply or modification of jigs, fixtures, templates and gauges
3	Evaluate jigs, fixtures, templates and gauges and related manufacturing processes	3.1	Review design and construction features and functions of jigs, fixtures, templates and gauges and related manufacturing processes
		3.2	Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques to evaluation
		3.3	Assess jigs, fixtures, templates and gauges for compliance with WHS and other regulatory and risk management requirements
		3.4	Assess jigs, fixtures, templates and gauges, products and processes for sustainability

- |   |                |   |
|---|----------------|---|
|   | 3.5            | Assess effectiveness of integration of jigs, fixtures, templates and gauges with lean systems and techniques used within the organisation |
|   | 3.6            | Review integration of jigs, fixtures, templates and gauges with production management and control software                                |
|   | 3.7            | Assess effectiveness of jigs, fixtures, templates and gauges for manufacturing process design and optimisation                            |
|   | 3.8            | Review jigs, fixtures, templates and gauges in relation to product manufacturability and process maintainability                          |
| 4 | Report results |   |
|   | 4.1            | Record results of evaluation  |
|   | 4.2            | Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files                                  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining role and benefit of jigs, fixtures, templates and gauges in a manufacturing process
- reviewing materials, treatments, finishing and assembly, and installation of jigs, fixtures, templates and gauges
- investigating sustainability implications of jigs, fixtures, templates and gauges
- selecting and using appropriate analysis techniques and software for evaluation of jigs, fixtures, templates and gauges
- identifying relevant WHS, regulatory and risk management compliance requirements
- relating use of jigs, fixtures, templates and gauges to:
  - lean manufacturing systems and techniques
  - requirements of manufacturing control software, such as system control and data acquisition software (SCADA)
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of jigs, fixtures, templates and gauges

- reporting and documenting scoping, principles and techniques identification and evaluation of jigs, fixtures, templates and gauges and related manufacturing processes, graphics and models

## Required knowledge

Required knowledge includes:

- WHS and regulatory compliance requirements, and risk management practices relevant to jigs, fixtures, templates and gauges and related manufacturing and maintenance processes
- typical range of jigs, fixtures, templates and gauge applications, including effects on:
  - repeatability of processes
  - accuracy and other quality requirements
  - labour and skill requirements for operations
- integration with or facilitation of jigs, fixtures, templates and gauges with lean manufacturing techniques, including:
  - standardisation
  - reduction of waste (also often called muda)
  - takt time
  - just in time (JIT)
- typical construction methods for jigs, fixtures, templates and gauges
- graphical representations and developments of jigs, fixtures, templates and gauges, including assemblies, component parts, operational overlays and user instructions
- dimensioning systems, including tolerances, limits and fits, and affect on manufacturing method
- materials and their applications in jigs, fixtures, templates and gauges
- positioning, locating and clamping methods
- design and simulation techniques, including use of CAD software for design and animations
- jig, fixture, template and gauge manufacturing techniques, such as:
  - fabrication and joining processes
  - machining (e.g. milling, turning and grinding)
  - post-processing of CAD files
  - computer numeric control (CNC) machining
  - electro-discharge machining (EDM)
  - 'rapid' (additive) processes
  - heat treatment,
  - surface treatments
  - finish grinding and polishing
- SCADA and other manufacturing control software and implications for jigs, fixtures, templates and gauges
- systems thinking, continuous improvement, constraint and contingency management, and comparative supply chain performance

- sustainability implications of jigs, fixtures, templates and gauges

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate jigs, fixtures, templates and gauges and their applications within manufacturing processes for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of jigs, fixtures, templates and gauges in manufacturing processes</li> <li>• review design and construction features, functions, applications and limitations of jigs, fixtures, templates and gauges</li> <li>• identify principles, design, analysis techniques and software required to evaluate and optimise jigs, fixtures, templates and gauges and related manufacturing processes</li> <li>• evaluate WHS, regulatory and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>

<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Jigs and fixtures</b>	Jigs and fixtures are used to position, hold and support components for assembly, fabrication or machining operations. Jigs also guide operations, such as drilling. Jigs and fixtures are specially designed so that large numbers of components can be machined or assembled identically while maintaining the correct relationship and alignment between the tool and the work piece, and to ensure interchangeability of components. A jig or fixture is designed and built to hold, support and locate a component (part) to ensure that it is drilled, machined or fabricated within the specified limits
<b>Templates</b>	Templates are production tools used to accurately manufacture

	duplicate and interchangeable parts and may perform positioning and guidance functions as well as profile checking for machining and fabrication operations
<b>Gauges</b>	<p>Gauges are used to check dimensions of components, machining operations or assemblies. For this unit gauges refers to:</p> <ul style="list-style-type: none"> <li>specifically manufactured items to allow quick dimensional or other checks, for example, go/no-go gauges with references or use of graduated devices or instruments</li> </ul>
<b>Features and functions, of jigs, fixtures, templates and gauges</b>	<p>Features and functions of jigs, fixtures, templates and gauges include:</p> <ul style="list-style-type: none"> <li>materials used in their construction</li> <li>method of fabrication (e.g. welding and machining)</li> <li>dimensions and tolerances</li> <li>method of holding or locating work pieces or production items</li> <li>method of installation and any capacity for operator adjustment during use</li> <li>method of adjustment for production changeover</li> <li>where the jig, fixture, template or gauge is being used by someone other than the designer or manufacturer, the degree of training required for its correct use</li> <li>any limitations on the use of the jig, fixture, template and gauge</li> <li>cost</li> <li>degree of saving generated by the jig, fixture, template or gauge over alternatives. The saving may be in: <ul style="list-style-type: none"> <li>quality</li> <li>error rate</li> <li>production capacity</li> <li>labour requirement</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to evaluation of jigs and fixtures

<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p>



	<p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Lean principles</b>	<p>Lean principles affecting tooling and related processes include:</p> <ul style="list-style-type: none"> <li>• tooling and processing costs</li> <li>• capacity and responsiveness to product demand</li> <li>• quality of product</li> <li>• reliability of tooling, process and supply</li> <li>• waste minimisation which includes ease of tool change</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# **MEM23135A Evaluate moulding tools and processes**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the evaluation of design features and functions of moulding tools and related processes. It includes injection moulds, blow, extrusion, compression, rotating, thermoforming and die casting moulds, and moulds for low volume components.

## **Application of the Unit**

This unit applies to moulding tools which manufacture components for engineering or related applications. It is suitable for people working as tool designers and maintenance technicians or paraprofessionals and draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Determine scope of moulding tool evaluation                 | 1.1 Identify moulding tools used and related moulded products for evaluation   |
|   |   | 1.2 Confirm stakeholders to be consulted on evaluation   |
|   |   | 1.3 Confirm that appropriate support, including technical and professional assistance, is available  |
|   |   | 1.4 Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures                |
|   |   |  |
| 2 | Prepare for evaluation of moulding tools                    | 2.1 Identify principles and techniques required to evaluate and optimise moulding tools and related manufacturing processes  |
|   |   | 2.2 Select appropriate analysis techniques, software and software validation techniques  |
|   |   | 2.3 Investigate sustainability implications of mould tooling and related manufacturing processes   |
|   |   |  |
| 3 | Evaluate moulding tools and related manufacturing processes | 3.1 Review design and construction features of functions of moulding tools and related manufacturing processes   |
|   |   | 3.2 Assess moulding tools and related manufacturing processes for compliance with WHS and other regulatory and risk management requirements                                |
|   |   | 3.3 Assess moulding tools, products and processes for sustainability   |
|   |   | 3.4 Assess suitability of moulding tools for integration with quick changeover, preventative maintenance and other lean manufacturing-related techniques                   |
|   |   | 3.5 Review integration of moulding tools with production management and control software   |
|   |   | 3.6 Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques to evaluation |

- |   |                |     |  |
|---|----------------|-----|--|
|   |                | 3.7 | Review tooling in relation to product manufacturability and process maintainability                      |
| 4 | Report results | 4.1 | Record results of evaluation   |
|   |                | 4.2 | Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining role and performance requirements of moulding tools in manufacturing processes
- reviewing moulding tool design and construction
- reviewing features and functions of moulding tool in relation to products produced with the tool and any limitations of moulding tools in the related manufacturing processes
- selecting and using appropriate analysis techniques and software for evaluation and optimisation of moulding tools and related manufacturing processes
- identifying WHS, regulatory and risk management compliance
- investigating sustainability implications of moulding tools and associated manufacturing processes
- assessing use of moulding tools for integration with:
  - lean manufacturing systems and techniques
  - manufacturing control software, such as system control and data acquisition (SCADA) software
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of moulding tools
- reporting and documenting scoping, principles and techniques identification and evaluation of tooling and related manufacturing processes, tooling graphics and models

### Required knowledge

Required knowledge includes:

- design parameters, construction features, functions and context of moulding tools in manufacturing operations

- sources of technical and professional assistance
- WHS and regulatory compliance requirements, and risk management practices for moulding tools and related manufacturing and maintenance processes
- sustainability and lean systems implications for mould tooling and related manufacturing processes
- range of moulding processes that use tooling, including:
  - injection moulding
  - blow moulding
  - extrusion moulding
  - compression moulding
  - rotational moulding
  - thermoform (vacuum) moulding
  - die casting
  - low volume and manual moulding
- moulding tool design features, functions and manufacturing techniques
- CAD design software and techniques, including software for:
  - analysis
  - mould flows
  - heat dissipation
- injection moulds process, including:
  - design features, functions and limitations
  - properties of materials for injection moulded components
  - enhanced injection moulding tools and processes
- blow moulds, including continuous and intermittent parison extrusion moulding, injection and stretch blow moulds:
  - enhanced blow moulding tools and techniques
  - properties of blow moulding materials)
- extrusion moulds, including:
  - design features, functions and limitations
  - properties of extruded materials
- compression moulds, including compression injection moulds:
  - design features functions and limitations
  - properties of materials for compression moulding
- rotating moulds:
  - design features functions and limitations
  - properties of materials for rotating moulded components, including acetal copolymer (POM)
- thermoforming (vacuum) moulds:
  - design features, functions and limitations
  - properties of materials for thermoformed components including amorphous thermoplastics and semicrystalline materials, with clearly defined melting points

- low volume moulds (e.g. flexible, laid up and sprayed shell moulds)
- die casting moulds:
  - design features functions and limitations
  - properties of materials for hot chamber die cast components
  - properties of materials for cold chamber die cast components
- analysis techniques, software and software validation techniques
- systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques
- reporting and documentation requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate moulding tools and processes for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of moulding tools in manufacturing processes</li> <li>• review design and construction features, functions, applications and limitations of moulding tools</li> <li>• identify principles, design, analysis techniques and software required to evaluate and optimise moulding tools and related manufacturing processes</li> <li>• evaluate WHS, regulatory and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics</li> </ul>

	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Features and functions of moulding tools</b>	<p>Features and functions of moulding tools include:</p> <ul style="list-style-type: none"> <li>materials used in their construction</li> <li>method of manufacture (e.g. welding and machining)</li> <li>dimensions and tolerances</li> <li>method of installation and any capacity for operator adjustment</li> </ul>
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	<p>during use</p> <ul style="list-style-type: none"> <li>• method of adjustment for production changeover</li> <li>• the degree of training of operators required before use of the moulding tool</li> <li>• any limitations on the use of the moulding tool</li> <li>• cost of manufacture</li> </ul>
<b>Injection moulded components</b>	<p>Injection moulded components include:</p> <ul style="list-style-type: none"> <li>• all thermoplastics</li> <li>• some thermosets and elastomers</li> <li>• metal powders, such as low alloy and stainless steels, soft magnetic and controlled expansion alloys</li> </ul>
<b>Enhanced injection moulding tools and processes</b>	<p>Enhanced injection moulding tools and processes may include:</p> <ul style="list-style-type: none"> <li>• multi-component and hard-soft injection moulding</li> <li>• microcellular foamed materials</li> <li>• powder injection moulding (PIM)</li> <li>• metal injection moulding (MIM)</li> <li>• gas or water assisted injection</li> </ul>
<b>Enhanced blow moulding tools and techniques</b>	<p>Enhanced injection moulding tools and processes may include:</p> <ul style="list-style-type: none"> <li>• multi-component and hard-soft injection moulding</li> <li>• microcellular foamed materials</li> <li>• powder injection moulding (PIM)</li> <li>• metal injection moulding (MIM)</li> <li>• gas or water assisted injection</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular moulding tool and process task</p>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as:</li> </ul>



	<ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> <li>• professional support for technologies, such as:             <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> </ul> <p>minimising the negative WHS impact on employees, community and customer</p>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> </ul>

	<ul style="list-style-type: none"> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Lean principles</b>	<p>Lean principles affecting tooling and related processes include:</p> <ul style="list-style-type: none"> <li>• tooling and processing costs</li> <li>• capacity and responsiveness to product demand</li> <li>• quality of product</li> <li>• reliability of tooling, process and supply</li> <li>• waste minimisation which includes ease of tool change</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# **MEM23136A Evaluate stamping and forging tools**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the evaluation of design features and functions of stamping and forging tools, and related processes. It includes cold piercing, punching, shearing, forming and drawing, and hot forging.

## **Application of the Unit**

This unit applies to the evaluation of stamping or forging tools used in manufacturing and engineering applications.

It is suitable for people working as tool designers and maintenance technicians or paraprofessionals and draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element.
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## Elements and Performance Criteria

1	Determine scope of stamping or forging tool evaluation	1.1	Determine parameters and context of stamping and forging tools in manufacturing operations
		1.2	Confirm stakeholders to be consulted on evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Prepare for evaluation of forging or stamping tool	2.1	Identify principles and techniques required to evaluate and optimise stamping and forging tools
		2.2	Select appropriate analysis techniques
		2.3	Investigate sustainability implications of forging or stamping tooling
3	Evaluate stamping and forging tools and related manufacturing processes	3.1	Review design and construction features of functions of stamping and forging tools, and related manufacturing processes
		3.2	Assess stamping and forging tools and related manufacturing processes for compliance with WHS and other regulatory and risk management requirements
		3.3	Assess stamping and forging tools, products and processes for sustainability
		3.4	Assess suitability of stamping and forging tools for integration with quick changeover, preventative maintenance and other lean manufacturing-related techniques
		3.5	Review integration of stamping and forging tools with production management and control software
		3.6	Apply systems thinking, continuous improvement,

- problem solving and decision making, and constraint and contingency management principles and techniques to evaluation
- 3.7 Review tooling in relation to product manufacturability and process maintainability
- 4 Report results
- 4.1 Record results of evaluation
- 4.2 Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining type, role and performance requirements of stamping and forging tools in manufacturing processes
- reviewing stamping and forging tool design and construction, including tooling materials, treatment, finishing and assembly, tool installation and operation
- reviewing features and functions of stamping and forging tools in relation to products produced with the tool and any limitations of the tool in the related manufacturing processes
- selecting and using appropriate analysis techniques and software for evaluation and optimisation of moulding tools and related manufacturing processes
- identifying WHS, regulatory and risk management compliance
- investigating sustainability implications of stamping and forging tools and associated manufacturing processes
- assessing use of stamping and forging tools to:
  - lean manufacturing systems and techniques
  - requirements of manufacturing control software, such as system control and data acquisition (SCADA) software
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of stamping and forging tools
- reporting and documenting scoping, principles and techniques identification and evaluation of tooling and related manufacturing processes, tooling graphics and models

### Required knowledge

Required knowledge includes:

- hot and cold working and recrystallisation temperature
- functions and context of stamping and forging tools in manufacturing operations
- sources of technical and professional assistance
- WHS and regulatory compliance requirements and risk management practices for stamping and forging tools and related manufacturing and maintenance processes
- sustainability and lean systems implications for stamping and forging tools and related manufacturing processes
- stamping and forging processes, plant and tooling, including:
  - shearing
  - drawing
  - impact deformation
  - other forging processes
- forged component materials, including carbon, alloy and stainless steels, tool steel, copper, nickel, aluminium and titanium alloys
- stamping and forging tools general design features, functions and constraints, including:
  - shearing die design
  - deep drawing tool design
  - forging die tool design
- tool manufacture processes:
  - post-processing of CAD files
  - lathes, milling machines, grinding machines, jig borers and jig grinders
  - computer numeric control (CNC) machining
  - electro-discharge machining (EDM) and wire EDM
  - drilling and tapping
  - 'rapid' processes
  - heat treatment and surface treatments
  - finish grinding and polishing
- tool design and analysis software, including:
  - CAD software
  - analysis software, mould flows, heat dissipation and software validation techniques
- systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques
- reporting and documentation requirements

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate stamping and forging tools and processes for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of stamping and forging tools in manufacturing processes</li> <li>• review design and construction features, functions, applications and limitations of stamping and forging tools</li> <li>• identify principles, design, analysis techniques and software required to evaluate and optimise stamping and forging tools and related manufacturing processes</li> <li>• evaluate WHS, regulatory and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and</li> </ul>

	<p>application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Features and functions, of stamping and forging tools</b>	<p>Features and functions of stamping and forging tools include:</p> <ul style="list-style-type: none"> <li>• materials used in their construction</li> <li>• method of manufacture</li> <li>• method of installation and any capacity for operator adjustment during use</li> <li>• method of adjustment for production changeover</li> <li>• the degree of training of operators required before use of the tool</li> <li>• any limitations on the use of the tool</li> <li>• cost of manufacture</li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> </ul>



	<ul style="list-style-type: none"> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain</p>

<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Lean principles</b>	<p>Lean principles affecting tooling and related processes include:</p> <ul style="list-style-type: none"> <li>• tooling and processing costs</li> <li>• capacity and responsiveness to product demand</li> <li>• quality of product</li> <li>• reliability of tooling, process and supply</li> <li>• waste minimisation which includes ease of tool change</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# **MEM23137A Evaluate rolling tools and processes**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers evaluation of hot and cold rolling tools for structural profiles and roll forming of sheet and strip. It includes roll design criteria, consideration of materials properties and product features, work health and safety (WHS) and sustainability implications.

## **Application of the Unit**

This unit applies to tooling used for industrial rolling of sheet and strip metal. It is suitable for people working as tool designers and maintenance technicians or paraprofessionals and draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23109A	Apply engineering mechanic principles

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of rolling tool evaluation	1.1	Identify rolling tools and related rolling products for evaluation
		1.2	Confirm stakeholders to be consulted on evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify relevant WHS and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Prepare for evaluation of rolling tools	2.1	Identify principles and techniques required to evaluate and optimise rolling tools and related manufacturing processes
		2.2	Select appropriate analysis techniques, software and software validation techniques
		2.3	Investigate sustainability implications of roll tooling and related manufacturing processes
3	Evaluate rolling tools and related manufacturing processes	3.1	Review design and construction features of functions of rolling tools and related manufacturing processes
		3.2	Assess rolling tools and related manufacturing processes for compliance with WHS and other regulatory and risk management requirements
		3.3	Assess rolling tools, roll products and related processes for sustainability
		3.4	Assess suitability of rolling tools for integration with quick changeover, preventative maintenance and other lean manufacturing-related techniques
		3.5	Review integration of rolling tools with production management and control software
		3.6	Apply systems thinking, continuous improvement,

- problem solving and decision making, and constraint and contingency management principles and techniques to evaluation
- 3.7 Review rolling tools in relation to product manufacturability and process maintainability
- 4 Report results
- 4.1 Record results of evaluation
- 4.2 Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining features and performance requirements of rolling tools in the manufacturing processes
- reviewing hot and cold rolling tools design and construction, including tooling materials, treatment, finishing and assembly, tool installation and operation, related manufacturing processes and materials processed
- selecting and using appropriate analysis techniques and software for evaluation and optimisation of rolling tools and related manufacturing processes
- identifying WHS, regulatory and risk management compliance
- investigating sustainability implications of rolling tools and associated manufacturing processes
- assessing use of rolling tools for integration with:
  - lean manufacturing systems and techniques
  - manufacturing control software, such as system control and data acquisition (SCADA) software
- establishing of cross-sectional dimensions
- developing of a flower pattern for progressive forming
- establishing product and roll orientation
- designing rolls to suit the flower pattern
- adding support operations, such as fixtures, guides, side rolls, straightening devices, cutting and punching
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of rolling tools

- reporting and documenting scoping, principles and techniques identification and evaluation of tooling and related manufacturing processes, tooling graphics and models

## Required knowledge

Required knowledge includes:

- properties of hot and cold working of metals and alloys, including:
  - recrystallisation temperature
  - grain size and microstructure
- functions and context of rolling tools in a manufacturing operation
- sources of technical and professional assistance
- WHS and regulatory compliance requirements and risk management practices for rolling tools and related manufacturing and maintenance processes
- sustainability and lean systems implications for rolling tools and related manufacturing processes
- hot rolling, including:
  - critical design considerations for tooling
  - multi-pass, multi-roll (eg. 3 high, 4 high mills) and reversing mills
  - range of hot rolled products
  - effect of hot rolling and variations in rolling process on properties of rolled materials
  - ring rolling
- cold rolling, including:
  - critical design considerations for tooling
  - related processes (e.g. pickling, cleaning, annealing and slitting)
  - range of cold rolled products
  - properties of cold rolled materials, including strength and hardness increase and ductility decrease
- hot and cold rolling effects
- roll forming:
  - thread rolling for screws and bolts
  - combined rolling techniques
- roll pass design features:
  - product mechanical properties:
    - yield strength in tension and shear
    - work hardening strain rate effect
    - driven and non-driven rolls, and applied tension
    - friction in rolling process
    - roll bite geometry
    - deflection compensation
  - roll materials, manufacture and heat treatment

- roll force, torque and power
- product guide systems
- roll and product temperature and cooling rate control
- roll forming pass design features
- labour and skills distribution requirements
- systems thinking, continuous improvement, constraint and contingency management, and comparative supply chain performance
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- documentation, drawings, specifications, instructions required, process information and programming

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate rolling tools and rolling processes for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine parameters and context of rolling tools in manufacturing processes</li> <li>• review design and construction features, functions, applications and limitations of rolling tools</li> <li>• identify principles, design, analysis techniques and software required to evaluate and optimise rolling tools and related manufacturing processes</li> <li>• evaluate WHS, regulatory and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made</li> </ul>

	<p>to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as:</li> </ul>
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	<ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> <li>• professional support for technologies, such as:             <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• WHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to roll tooling for engineering and related application tasks</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative WHS impact on employees, community and customer</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking refers to the conduct of engineering work in a manner that demonstrates knowledge of how the interaction of different technical systems on equipment, machinery or structures, as well as the skills and techniques of personnel, combine to perform or support engineering-related operations, processes or projects. It embraces determining or establishing how the function of each technical system or component, as well as the skills and</p>

	techniques of personnel, effects or potentially may effect, outcomes. Systems should be interpreted broadly within the context of the organisation and depending on the project or operation can include equipment, related facilities, material, software, internal services and personnel, and other organisations in the value chain
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Constraints and contingencies may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisational, procedural or cultural</li> <li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li> <li>• design constraints imposed by materials or process limitations</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# **MEM23138A Evaluate suitability of materials for engineering-related applications**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the evaluation of materials for their suitability in engineering-related projects or processes. It requires consideration of materials in regards to design requirements, sustainability, product manufacturability, facilities, services, plant and tooling requirements, and safe use.

## **Application of the Unit**

This unit applies to materials used in manufacturing, engineering or related applications. It is suitable for people working as manufacturing, maintenance, design and drafting technicians or paraprofessionals, and those pursuing manufacturing engineering or related technical qualifications.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine scope of materials evaluation	1.1	Identify materials to be evaluated and their related manufacturing or engineering-related applications
		1.2	Confirm stakeholders to be consulted on the evaluation
		1.3	Confirm that appropriate support, including technical and professional assistance, is available
		1.4	Identify relevant work health and safety (WHS) and regulatory requirements, standards, codes of practice, risk management and organisational procedures
2	Prepare for evaluation	2.1	Review design information for related products and processes for material specifications
		2.2	Identify analysis principles and techniques relevant to the materials, processes, services, plant and tooling covered by the evaluation
		2.3	Identify appropriate analysis software and software validation techniques
		2.4	Investigate sustainability implications of materials and related manufacturing or engineering processes
3	Evaluate materials and processes for an application	3.1	Determine properties of materials under evaluation, including supervising any required tests
		3.2	Assess materials and related processes for compliance with WHS and other regulatory and risk management requirements
		3.3	Assess material, product and processes for sustainability
		3.4	Review materials for product and process suitability and process optimisation
		3.5	Apply systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques

to evaluation

- |   |                |     |  |
|---|----------------|-----|--|
| 4 | Report results | 4.1 | Record results of evaluation   |
|   |                | 4.2 | Provide documentation, such as tool, product and process analysis, and computer-aided design (CAD) files |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining context, specification and performance requirements of materials in manufacturing and engineering-related applications
- investigating sustainability implications of materials in the context of their manufacturing and engineering-related use
- identifying materials processing principles, techniques and requirements, including associated facilities, services, plant, tooling and software
- identifying WHS, regulatory and risk management compliance
- identifying materials and material use and processing for integration with:
  - lean manufacturing systems and techniques
  - manufacturing control software, such as system control and data acquisition (SCADA) software
- applying systems thinking, continuous improvement, and constraint and contingency management to evaluation of materials in manufacturing and engineering applications
- reporting and documenting results of evaluation

### Required knowledge

Required knowledge includes:

- sources of technical and professional assistance
- sustainability implications of materials and related manufacturing and engineering-related products and processes
- WHS and regulatory compliance requirements and risk management practices related to materials, including use of material safety data sheets (MSDS)
- software options for materials and process analysis
- common materials, properties and structures in manufacturing and engineering, including:

- mechanical, electrical, thermal, optical, chemical and magnetic properties
- ferrous and non-ferrous metals and alloys
- polymers
- ceramics
- glass
- composites
- cold working of metals
- metal heat treatment
- processes for working, shaping and joining of materials, including:
  - metal machining
  - metal cutting
  - casting and moulding of metals
  - fabricating and welding of ferrous, non-ferrous metals and plastics
  - injection, compression and blow moulding of plastics
  - extrusion of plastics and metals
  - electroplating
  - powder coating
  - composite lay-up and moulding
  - sintering of plastic and metal powders
  - additive and rapid processes
  - casting of metals
  - stamping, drawing and roll forming of sheet metals
  - forging of metals
  - hot and cold rolling of billets, structural sections and coiled sheet
- systems thinking, continuous improvement, problem solving and decision making, and constraint and contingency management principles and techniques
- reporting and documentation requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to evaluate materials used in manufacturing and engineering for safety, economy and fitness for purpose.
<b>Critical aspects for assessment and evidence required to demonstrate</b>	Assessors must be satisfied that the candidate can competently and consistently:

<b>competency in this unit</b>	<ul style="list-style-type: none"> <li>• determine suitability of materials for manufacturing and engineering applications and processes</li> <li>• investigate sustainability implications for materials and related applications</li> <li>• determine and review material properties related to a range of applications</li> <li>• identify materials processing principles and techniques, including facilities, services, plant and tooling, and analysis techniques and software</li> <li>• evaluate WHS, regulatory and risk management compliance</li> <li>• report and document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>

	<ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>WHS, regulatory requirements and enterprise procedures</b>	<p>WHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>WHS Acts and regulations</li> <li>relevant standards</li> <li>codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> </ul>



	<ul style="list-style-type: none"><li>state and territory regulatory requirements applying to electrical work</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to manufacturing processes for engineering or related applications
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>meeting all regulatory requirements</li><li>conforming to all industry covenants, protocols and best practice guides</li><li>minimising ecological and environmental footprint of process, plant and product</li><li>maximising economic benefit of process plant and product to the organisation and the community</li><li>minimising the negative WHS impact on employees, community and customer</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# MEM23139A Design a basic single zone duct distribution system

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the skills and knowledge required to use air flow and distribution principles used in heating, ventilation, air conditioning and refrigeration (HVAC/R) systems and to identify different system configurations to design a single, one-air distribution system and service related system components.

## Application of the Unit

The unit applies to the design of single, one-air distribution system and service-related system components, including meeting environmental and cost control requirements. The unit may be applied to individuals working alone or as part of a design team.

The unit is suitable for people working as supervisors, technicians and HVAC/R draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM30031A	Operate computer-aided design (CAD) system to produce basic drawing elements
MEM30033A	Use computer-aided design (CAD) to create and display 3-D models

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Determine design specification for basic single zone duct distribution system | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area   |
|   |   | 1.2 | Determine design requirements for the single zone duct distribution system from customer requirements, job specifications, and briefings or discussions with appropriate personnel |
|   |   | 1.3 | Identify and interpret relevant codes and standards  |
|   |   | 1.4 | Prepare final specifications for the design and obtain relevant approvals  |
|   |   | 1.5 | Identify sources of professional and technical assistance  |
|   |   | 1.6 | Establish coordination and contingency management requirements of design work with other HVAC/R and building systems team members  |
|   |   | 1.7 | Obtain resources required for the design task in accordance with enterprise procedures   |
| 2 | Design basic single zone duct distribution system                             | 2.1 | Review options for basic single zone duct distribution system design and compare against specified requirements  |
|   |   | 2.2 | Select most suitable single zone duct distribution system design to meet requirements  |
|   |   | 2.3 | Use 3-D CAD system to design layout and other features of single zone duct distribution system against   |

- requirements
- 2.4 Select appropriate duct materials and duct system components, including an appropriate fan for distribution
  - 2.5 Consult as appropriate on any design adjustments required to meet contingencies and unexpected situations
  - 2.6 Review design for cost reductions and compliance with environmental and regulatory requirements, as appropriate
  - 2.7 Review final design with appropriate personnel and make any required adjustments
- 3 Evaluate and finalise design
    - 3.1 Prepare final design documentation, including construction documentation if required
    - 3.2 Prepare final report according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting air-diffusion
- sizing the system
- selecting fans
- designing duct work
- applying cost controlling strategies
- using 3-D CAD systems effectively
- interpreting drawings and specifications
- communicating effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

## Required knowledge

Required knowledge includes:

- differentiation between static, velocity and total pressure in air distribution ducts
- laminar and turbulent flow
- use of Moody diagram for flow rate and pressure drop
- friction and dynamic pressure loss
- Colebrook-White formula
- sources of heat and pressure leakage and loss calculation
- noise minimisation
- fan laws
- control cost parameters
- duct design parameters, including:
  - standard duct sizes and gauges
  - available access and space
  - system performance requirements
- system sizing and balancing methods
- dual and single duct constant volume air systems
- variable volume air system
- multi-zone systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to design basic single zone duct distribution systems to meet customer requirements, including cost specifications, and WHS and other regulatory requirements.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including risk control measures</li> <li>• design basic single zone duct distribution systems to customer performance and cost requirements</li> <li>• select and size appropriate components, including fans and duct work</li> </ul>

	<ul style="list-style-type: none"> <li>communicate technical requirements to others, including preparation of required drawings, CAD files and reports.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation</li> <li>• protective equipment</li> <li>• material safety management systems, including use of material safety data sheets (MSDS)</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• WHS provisions in relevant awards and agreements</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>
<b>Single zone duct distribution system</b>	<p>A single zone duct distribution system is a basic central system which can supply a constant air volume or a variable air volume at low, medium or high pressure through a single duct</p>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• use of tools and equipment</li> <li>• operating instructions, including job sheets, plans, drawings and designs</li> </ul>

	<ul style="list-style-type: none"> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• site operational procedures</li> <li>• references to industry standards</li> </ul>
<b>Resources</b>	<p>Resources may include:</p> <ul style="list-style-type: none"> <li>• reference manuals</li> <li>• scientific calculator</li> <li>• 3-D CAD software</li> <li>• computer workstation and software, either stand alone or networked</li> <li>• test apparatus</li> <li>• appropriate tools of trade, equipment and materials</li> <li>• standard duct sizes and gauges</li> </ul>
<b>Contingencies and unexpected situations</b>	<p>Contingencies and unexpected situations that arise during the course of the design process may include:</p> <ul style="list-style-type: none"> <li>• cost or time overruns</li> <li>• unavailability of required components</li> <li>• changes in customer requirements after design process has started</li> <li>• regulatory change</li> <li>• site or building features not on plans or drawings</li> <li>• other situations not included in customer brief or normal enterprise procedures</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.



## **MEM23140A Determine operational parameters for building HVAC hydronic systems**

### **Modification History**

Release 1 (MEM05v9).

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify fluid flow and distribution characteristics of hydronic systems and measure system component performance, including chillers, boilers and flow control devices.

### **Application of the Unit**

The unit applies to technicians required to determine features and performance of heating, ventilation and air conditioning (HVAC) hydronic systems, including performance and characteristics of components, piping and the overall system. The unit applies to design, manufacture, installation or servicing work in HVAC enterprises.

The unit is suitable for people working as, supervisors, technicians, and HVAC draftspersons and those pursuing manufacturing engineering or related technical qualifications and careers.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine parameters of HVAC hydronic system assessment	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Identify consultation and coordination requirements with, client and other HVAC and building systems team members
		1.3	Identify characteristics and specifications of the HVAC hydronic system from installations and/or mechanical service drawings, data sheets and manufacturer specifications
		1.4	Identify system components relevant to determination of operational parameters
		1.5	Predict system and component performance using installation/service drawings, data sheets and manufacturer specifications
		1.6	Identify sources of professional and technical assistance
		1.7	Obtain resources required for HVAC hydronic task in accordance with enterprise procedures
2	Determine flow component performance	2.1	Identify operating characteristics and performance data of pumps
		2.2	Identify flow control devices and check piping for correct sizing
		2.3	Measure and check fluid flow against specifications
3	Identify required hydronic piping	3.1	Establish the operational requirements of the piping system in a HVAC installation

system	3.2	Select a suitable hydronic piping system from given piping specifications and data
	3.3	Apply enterprise risk management procedures for contingencies and unexpected situations
4 Analyse hydronic system performance	4.1	Verify system performance using practical or software modelling techniques
	4.2	Model HVAC system to determine system expected performance
	4.3	Document system performance analysis according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting drawings and specifications
- recognising system features and operational modes from drawings, manuals and specifications
- selecting and testing of pumps
- measuring of flow rates
- selecting valve/flow control devices and piping for given applications
- determining system performance parameters and analysing against specifications
- using appropriate modelling software
- communicating effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- system operation features:

- closed/open systems
- pump head/lift and static head (high rise building)
- system friction losses
- net positive suction head
- system curves
- pumps:
  - types
  - selection criteria
  - performance characteristics
  - bladder tanks
  - coil characteristics
  - heat exchangers (plate, shell and tube, tube in tube)
  - flow measurements
  - flow switchers
  - boilers (types and performance characteristics)
  - cooling towers types and elementary cooling thermodynamics
- valves:
  - types and applications
  - throttle characteristics
  - flow measurements
  - selection and applications
- pipe sizing and relationship to system performance
- standard pipe sizes and specifications

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to identify fluid flow and distribution characteristics of hydronic systems and measure system component performance, including chillers, boilers and flow control devices.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including risk control measures</li></ul>

	<ul style="list-style-type: none"> <li>• determine operational parameters for building HVAC hydronic systems</li> <li>• measure individual component performance of: <ul style="list-style-type: none"> <li>• chillers</li> <li>• boilers</li> <li>• pumps</li> <li>• piping</li> <li>• flow control devices</li> </ul> </li> <li>• communicate technical requirements to others, including preparation of required drawings, CAD files and reports.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Environmental requirements</b>	Environmental requirements include: <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Componentry</b>	Componentry includes: <ul style="list-style-type: none"><li>• valves</li></ul>

	<ul style="list-style-type: none"><li>• pumps</li><li>• heat exchangers</li><li>• bladder tanks</li><li>• flow switchers</li><li>• boilers</li><li>• cooling towers</li><li>• hydronic piping systems</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• reference manuals</li><li>• scientific calculator</li><li>• 3-D computer-aided design (CAD) software</li><li>• computer workstation and software, either stand alone or networked</li><li>• test apparatus</li><li>• appropriate tools of trade, equipment and materials</li><li>• standard duct sizes and gauges</li></ul>
<b>Contingencies and unexpected situations</b>	Contingencies and unexpected situations that arise during the course of the assessment process may include: <ul style="list-style-type: none"><li>• cost or time overruns</li><li>• unavailability of required resources</li><li>• regulatory change</li><li>• system, site or building features not on plans or drawings</li><li>• other situations not included in original brief or normal enterprise procedures</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# MEM23141A Complete a building thermal performance survey

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the skills and knowledge required to carry out a detailed heat load estimate for a multiple zone commercial/industrial building and then analyse building thermal performance and document results.

## Application of the Unit

The unit applies to technicians in heating, ventilation and air conditioning (HVAC) manufacturing, servicing and maintenance enterprises who are required to conduct a building performance survey in order to inform the design and specification of HVAC equipment and system/s for a multiple zone commercial/industrial building, including consideration of improvements to building design.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit of competency.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23142A	Determine psychrometric processes and system performance

## Employability Skills Information

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Estimate heat load for a multiple zone commercial/industrial building | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area   |
|   |   | 1.2 | Determine extent of the performance survey from work sheets, drawings, building specifications or other documentation and discussions with appropriate personnel |
|   |   | 1.3 | Determine sources of heat gains  |
|   |   | 1.4 | Coordinate work effectively with all team members  |
|   |   | 1.5 | Obtain and check resources and equipment required for the performance survey   |
| 2 | Analyse the air conditioning heat and cooling load                    | 2.1 | Complete room sensible and latent heat estimates of a multiple zone building   |
|   |   | 2.2 | Identify peak effective room latent, and sensible and latent heat loads over time of day and year for each zone  |
|   |   | 2.3 | Determine the thermal performance of the building using simulation software  |
| 3 | Investigate building design improvement options                       | 3.1 | Analyse alternative building design improvement options with respect to the effect on thermal performance using simulation software                              |
|   |   | 3.2 | Identify unacceptable high thermal loads on the building using check figures and industry standards  |
|   |   | 3.3 | Prepare recommendations for changes in building design/treatment to eliminate unacceptably high thermal loads  |

- |   |                       |     |  |
|---|-----------------------|-----|--|
|   |                       | 3.4 | Document and recommend improvements of thermal performance of the building to appropriate personnel  |
|   |                       | 3.5 | Consult as required on unexpected situations and take appropriate action   |
| 4 | Specify system design | 4.1 | Determine equipment size, including coil and air handling unit capacities for constant and variable volume systems, and central refrigeration and boiler capacities based on the recommendations |
|   |                       | 4.2 | Document the completed survey with all recommendations, building design improvements/treatments, and appropriate system design specifications according to enterprise procedures                 |
|   |                       | 4.3 | Prepare a formal survey report in consultation with appropriate personnel and enterprise procedures  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- sourcing appropriate drawings, documentation and specifications for buildings
- interpreting building design information for sources of heat gains
- computing standard thermal values in relation to a commercial/industrial building
- computing internal and system heat gains
- using American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook or similar Australian data books to determine design data
- using suitable computer software to determine equipment size for constant and variable volume systems and central refrigeration and boiler capacities
- communicate effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- heat gains in buildings
- heat transfer theory
- thermal properties of building materials, including materials designed to promote thermal conductivity or insulation
- heat transfer in buildings, including effects of:
  - ambient conditions
  - materials and equipment
  - windows and films
  - design effects, including external design, room and door design, and sun position calculations
- building heat flow, losses and gains, including:
  - convection
  - radiation
  - conduction
  - heat paths
- building heat loss and gain calculations
- thermal properties of buildings, including losses
- people loads
- cost implications of air conditioning and heating designs
- heat loads calculations, including lighting and equipment
- thermal lag
- relevant legislation and codes of practice
- energy efficiency and sustainability

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures</li><li>• demonstrate essential knowledge and skills to complete a building thermal performance survey</li><li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li></ul>
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	<ul style="list-style-type: none"> <li>• carry out a building survey and load estimate for a multiple zone commercial building</li> <li>• complete a building thermal performance survey for different buildings. This must include: <ul style="list-style-type: none"> <li>• minimum five (5) zones</li> <li>• internal and system heat gains</li> <li>• infiltration and fresh air rates</li> <li>• heat flow through windows accounting for internal and external shading</li> <li>• heat flows through building fabric</li> <li>• use of simulation software.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Heat gains</b>	<p>Heat gains may include:</p> <ul style="list-style-type: none"> <li>• external</li> </ul>

	<ul style="list-style-type: none"> <li>• internal</li> <li>• system</li> <li>• U values and infiltration rates for various wall/roof constructions</li> <li>• measure sun azimuth and altitude angles, and overall shade factors for various windows</li> </ul>
<b>Resources and equipment</b>	<p>Resources and equipment may include:</p> <ul style="list-style-type: none"> <li>• computer workstation</li> <li>• appropriate simulation and reporting software</li> <li>• reference manuals and charts</li> <li>• appropriate measurement equipment</li> <li>• building codes and codes of conduct</li> <li>• access to legislative and regulatory requirements</li> <li>• technical library</li> <li>• stationery</li> <li>• scientific calculator</li> <li>• appropriate tools of trade, equipment and materials</li> </ul>
<b>Industry standards</b>	<p>Industry standards include:</p> <ul style="list-style-type: none"> <li>• AS 1668 Parts 1 &amp; 2. The use of Mechanical Ventilation and Air Conditioning in Buildings</li> <li>• EU Guidelines on ventilation</li> <li>• ASHRAE 62-89 Ventilation standard</li> <li>• AUBRCC or Building Code of Australia (BCA)</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• site operational procedures</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# **MEM23142A Determine psychrometric processes and system performance**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify psychrometric processes and determine system performance in a commercial building.

## **Application of the Unit**

The unit applies to technicians in enterprises designing, manufacturing, installing, servicing or maintaining heating, ventilation, air conditioning and refrigeration (HVAC/R) equipment.

The unit is suitable for people working as, supervisors, technicians and HVAC/R draftspersons, and those pursuing manufacturing engineering or related technical qualifications and careers.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Review psychrometric processes                                     | 1.1 Obtain and implement work health and safety (WHS) and environmental requirements for a given work area   |
|   |  | 1.2 Apply knowledge of psychrometric processes to analytical solutions to HVAC/R systems according to enterprise procedures  |
|   |  | 1.3 Diagnose air temperature and humidity problems using psychrometric charts  |
|   |  | 1.4 Consult appropriate personnel to ensure that work is coordinated effectively with others   |
| 2 | Analyse the psychrometric and system performance of HVAC/R systems | 2.1 Determine plant/system capacity and airflow requirements for effects of coil bypass factor and apparatus dew point (ADP) and partial load control                      |
|   |  | 2.2 Calculate dehumidified air quantity using both target superheat (TSH) and effective room sensible heat (ERSH) methods  |
|   |  | 2.3 Establish plant capacity and air flow rates for the system/building  |
|   |  | 2.4 Establish air side systems and determine system performance  |
|   |  | 2.5 Determine systemic performance parameters  |
|   |  | 2.6 Consult as required on any contingencies and unexpected situations and take appropriate action based on specifications, codes and standards, and enterprise procedures |
| 3 | Document and   | 3.1 Evaluate solutions to psychrometric and system   |

report on psychrometric and HVAC/R system performance		performance to determine their effectiveness
	3.2	Report and document analysis, including details of all findings, calculations and assumptions, according to enterprise procedures
	3.3	Prepare and justify recommendations for any required actions in relation to HVAC/R equipment

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- plotting the psychrometric performance of a given HVAC/R coil
- calculating the psychrometric performance of the coil
- calculating the psychrometric performance of HVAC/R spray equipment
- calculating required plant capacity and airflow rates
- determining the psychrometric performance of a HVAC/R system in operation, including partial load control
- interpreting drawings and specifications
- communicating effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- adiabatic/evaporative cooling
- isothermal humidification
- cooling and dehumidification with high latent load
- cooling and dehumidification with all outdoor air
- cooling and dehumidification with all outdoor air and with dehumidified air requirements less than supply air
- cooling with evaporative humidification
- spray processes to include cooling and dehumidification, cooling and humidification with heated spray water, heating and humidification:
  - partial load processes

- reheat
- bypass of return air and mix of return air and outside air:
  - variable air volume
  - variable coil effective surface temperature
- analysis of cooling coil selection and performance
- psychrometric analyses, formulae and charts
- indirect evaporative coolers
- analysis of cooling coil selection and performance
- cooling tower characteristics

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures</li><li>• demonstrate essential knowledge and skills to determine psychrometric processes and system performance</li><li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li><li>• demonstrate the ability to determine psychrometric processes and system performance consistently for commercial buildings. This includes determining the plant capacity and airflow rates for a building and the ability to analyse system 'air side systems' and determine system performance.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li><li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li></ul>

<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li><li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li><li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li><li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li><li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment may be in conjunction with assessment of other units of competency where required.</li></ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Environmental requirements</b>	Environmental requirements include: <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li></ul>

	<ul style="list-style-type: none"><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Systemic performance parameters</b>	Systemic performance parameters may include: <ul style="list-style-type: none"><li>• coil characteristics</li><li>• spray processes</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# MEM23143A Apply energy management principles

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the skills and knowledge required to determine an implementation strategy for an energy management program for the purpose of monitoring, fault-finding and managing a building management system (BMS).

## Application of the Unit

The unit applies to technicians in enterprises designing, manufacturing, installing, servicing or maintaining heating, ventilation, air conditioning and refrigeration (HVAC/R) equipment who are required to determine or audit energy management procedures for a building. The unit assumes that the building has a BMS.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential

Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine energy sources used in HVAC/R and their primary function in building energy management programs	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Identify passive energy characteristics in the building design and predict their impact on energy management
		1.3	Identify common energy sources, their standard units and local supply authorities and evaluate for safe usage
		1.4	Establish the operating functions of all principle hardware components in a BMS
		1.5	Identify energy requirements for major system components operating within their normal range
		1.6	Consult with appropriate personnel to ensure that work is coordinated effectively with others
2	Monitor a building management system	2.1	Check and monitor equipment status using energy management functions and data from BMS
		2.2	Use BMS software to access, monitor and control system components
		2.3	Check status of monitored BMS for compliance with specified normal operating parameters and environmental requirements
		2.4	Predict the annual consumption of major system components
		2.5	Consult as required on any contingencies and unexpected situations and take appropriate action based on specifications, codes and standards, and enterprise procedures
3	Conduct an energy audit for a	3.1	Determine objectives of a HVAC/R maintenance management system



building	3.2	Evaluate energy costs and tariffs for local supply authorities
	3.3	Determine methodology for the auditing process, including data gathering techniques
	3.4	Prepare appropriate energy audit documentation and implementation strategy for an energy management program in a multi-storey building
4 Plan efficient energy management operations	4.1	Incorporate requirements of an energy efficient plant control system into building operation procedures, including suitable contingency and suitable risk management procedures
	4.2	Compile plant operating annual reporting timetable
	4.3	Advise on staff awareness raising policy for energy conservation in a multi-storey building

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- monitoring data of a BMS
- implementing energy management procedures for a building
- planning and conducting an energy audit
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- units of measure, characteristics and supply for common energy sources
- typical energy sources, characteristics and uses
- energy usage within a multi-storey building
- energy auditing process
- system operation for energy efficiency and relevant standards
- implementing energy management procedures for a building
- BMS attributes, such as functions, hardware, inputs and outputs

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate essential knowledge and skills as described in this unit</li> <li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the ability to apply energy management principles, monitor building management systems, conduct energy audits and plan efficient energy management operations.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with</li> </ul>

	<p>application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> </ul>

	<ul style="list-style-type: none"> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Common energy sources</b>	<p>Common energy sources include:</p> <ul style="list-style-type: none"> <li>• electricity</li> <li>• steam</li> <li>• hot water</li> <li>• high temperature hot water</li> <li>• natural gas</li> <li>• liquefied petroleum gas (LPG)</li> <li>• solar</li> <li>• waste heat</li> <li>• petrol</li> <li>• diesel</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> <li>• industry standards</li> </ul>
<b>Energy management</b>	<p>Energy management may include:</p> <ul style="list-style-type: none"> <li>• night cycles</li> <li>• optimum stop/start</li> <li>• time and event programs</li> <li>• night purge</li> </ul>

	<ul style="list-style-type: none"><li>• outside air percentage control</li><li>• enthalpy</li><li>• power demand control</li><li>• duty cycle</li><li>• presence detection</li><li>• lighting control</li></ul>
<b>Auditing process</b>	<p>Auditing process may include:</p> <ul style="list-style-type: none"><li>• energy costs and tariffs</li><li>• energy consumption</li><li>• predicting future costs</li><li>• plotting consumption trends</li><li>• historical data</li><li>• collecting information using surveys</li><li>• comparisons of actual to recorded usage</li><li>• energy balance</li><li>• instrumentation</li><li>• BMS</li><li>• estimating savings potential</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23144A Contribute to the design of a commercial refrigeration system**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to contribute to the design of commercial refrigeration systems or for less complex systems to undertake the complete design. The unit includes applying of refrigeration and food storage technology, using standard manufactured components and piping, following design specifications, documenting system design and complying with safety and regulatory requirements.

## **Application of the Unit**

The unit applies to technicians in enterprises that design commercial refrigeration equipment. The unit applies to team situations where the technician may working with engineers and other technicians from the heating, ventilation, air conditioning and refrigeration (HVAC/R) and other disciplines on large design projects as well as individual design work that is within the technician's skill and knowledge.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23129A	Evaluate thermal loads in heating, ventilation, air conditioning and refrigeration

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine optimum system design for a given application	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Consult appropriate personnel to determine system specifications and final confirmation is obtained
		1.3	Plan design development work to meet scheduled timelines in consultation with others involved on the worksite
2	Design system	2.1	Design system taking into account safety, regulatory requirements, relevant standards, system specifications and budgetary constraints
		2.2	Determine selected equipment required for the systems and locations in accordance with the design specifications and enterprise procedures
		2.3	Check system design draft for compliance with the design brief, regulatory requirements and environmental standards
		2.4	Document, validate and approve system design according to enterprise procedures
		2.5	Consult as appropriate on any design adjustments required to meet contingencies and unexpected situations
3	Validate system performance	3.1	Establish operating criteria for expected ambient conditions

- 3.2 Determine and validate likely operating characteristics for a given refrigeration load against the design specifications and standards
- 3.3 Adjust the functional design and remap operating characteristics to achieve optimal system performance
- 3.4 Program the control system to meet the operational requirements
- 3.5 Document the designed system and its validation according to enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- selecting appropriate system components
- applying relevant standards and regulatory requirements to the design task
- documenting technical information and designs
- interpreting and applying manufacturers' data, tables and specifications
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- working in teams with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- standards and codes relevant to commercial refrigeration systems
- calculation of capacity in heat exchangers
- commercial refrigeration systems features and components:
  - applications
  - system requirements
  - operating conditions and criteria



- refrigerants
- refrigeration cycle
- evaporators
- condensers
- compressors
- liquid expansion devices
- system load balance point
- line sizing
- automatic controls
- commercial refrigeration and integration with an energy management system (E.M.S)
- E.M.S. control components and the function and operating parameters
- E.M.S system design, applications, operation and maintenance

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate essential knowledge and to design a commercial refrigeration system</li> <li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the design of commercial a refrigeration system consistently. One application must be related to food storage. The design must include standard manufactured components and piping, adherence to design specifications, documenting system design and compliance with safety and regulatory requirements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be</li> </ul>

	demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li><li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li><li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li><li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li><li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment may be in conjunction with assessment of other units of competency where required.</li></ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
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<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Standards</b>	<p>Relevant standards may include:</p> <ul style="list-style-type: none"><li>• AS 1677 Refrigeration systems</li><li>• AS 3666 Air handling and water systems of buildings – Microbial control</li><li>• Ozone protection regulations</li><li>• International Institute of Ammonia Refrigeration (IIAR) Ammonia Data Book</li><li>• American National Standards Institute (ANSI)/International Institute of Ammonia Refrigeration (IIAR) standards</li><li>• American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and Mechanical Refrigeration standards</li></ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"><li>• use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li></ul>

	<ul style="list-style-type: none"><li>• manufacturer specifications</li><li>• site operational procedures</li><li>• references to industry standards</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# **MEM23145A Apply codes and regulations to air conditioning designs**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply standards, codes of practice and regulatory requirements to produce air conditioning designs for typical large scale plant and multi-zone applications.

## **Application of the Unit**

The unit applies to heating, ventilation, air conditioning and refrigeration (HVAC/R) technicians in enterprises that design air conditioning systems for typical large scale plant and multi-zone applications. The unit may be applied to working within a design team or to individual design tasks.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit.

## **Pre-Requisites**

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23140A	Determine operational parameters for building HVAC/R hydronic systems
MEM23142A	Determine psychrometric processes and system performance

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Prepare for design compliance analysis | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area   |
|   |  | 1.2 | Identify air conditioning codes and regulations relevant to zoning and usage together with environmental requirements from the client design requirement brief |
|   |  | 1.3 | Consult with appropriate personnel to ensure that work is coordinated effectively with others  |
|   |  | 1.4 | Obtain equipment and resources needed for the task in accordance with enterprise procedures  |
|   |  |     |  |
| 2 | Analyse design for compliance          | 2.1 | Check and validate proposed air conditioning system compliance against relevant codes and regulations  |
|   |  | 2.2 | Prepare recommendations on any identified compliance issues relating to codes and regulations  |
|   |  | 2.3 | Discuss recommendations on any proposed design modifications with appropriate personnel, as required   |
|   |  | 2.4 | Consider alternative design and other solutions to meet codes and regulations requirements are proposed according to enterprise procedures if appropriate      |
|   |  |     |  |
| 3 | Record findings                        | 3.1 | Document outcomes of the analysis according to enterprise procedures   |
|   |  | 3.2 | Document recommendations for any design rectifications, including details of all findings, calculations and assumptions  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting air conditioning standards, codes and regulations, including relevant WHS and environmental standards, regulations and codes
- applying relevant standards and regulatory requirements to the design task
- interpreting client requirements and specifications against codes and regulations
- documenting technical information and designs for compliance
- using relevant software tools effectively
- communicating effectively with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- relevant design criteria for typical large scale air conditioning plant and multi-zone applications
- air conditioning system selection criteria
- zoning and building usage and relevance to regulatory compliance of large scale air conditioning systems
- regulatory requirements which can impact on final design

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures</li><li>• demonstrate essential knowledge and skills to apply codes and regulations to air conditioning design</li><li>• demonstrate competence within a timeframe typically expected of the discipline, work function and</li></ul>
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	<p>industrial environment</p> <ul style="list-style-type: none"> <li>demonstrate the ability to apply codes and regulations to air conditioning system designs through a compliance analysis taking into account all applicable regulatory requirements and make appropriate recommendations on how non-compliant systems can be rectified. This must be demonstrated consistently on different systems.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>



## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Air conditioning codes and requirements</b>	Air conditioning codes and requirements may include: <ul style="list-style-type: none"><li>• Building Code of Australia (BCA)</li><li>• regulations under State/Territory Government Acts</li><li>• local government by-laws</li><li>• emergency service requirements</li><li>• codes of practice</li></ul>
<b>Environmental requirements</b>	Environmental requirements include: <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li></ul>

	<ul style="list-style-type: none"><li>• customer</li><li>• client</li></ul>
<b>Zoning and usage</b>	Zoning and usage may include: <ul style="list-style-type: none"><li>• air conditioning system</li><li>• building construction features</li><li>• occupancies</li><li>• energy conservation techniques</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• scientific calculator</li><li>• technical charts and tables</li><li>• building plans</li><li>• suitable software</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li><li>• appropriate tools of trade, equipment and materials</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# **MEM23146A Contribute to the design of industrial refrigeration systems**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to contribute to the design of industrial refrigeration systems or for less complex systems to undertake the complete design. The unit includes the determination of the specific type of system and selection of major system components and materials using manufacturer's data to determine performance aspects of systems for a given application.

## **Application of the Unit**

The unit applies to technicians in enterprises that design whole refrigeration systems or design modifications to existing systems, including systems incorporating multiple evaporators and compressors, moderate and low temperature, indirect refrigeration and flooded systems.

The unit applies to design work undertaken as part of a design team comprising engineers and other technicians and to individual design tasks within the technician's skill and knowledge.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Determine design specification and select components for an industrial refrigeration system | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area                                  |
|   |   | 1.2 | Determine design requirements from client requirements, job specifications, briefings and/or discussions with appropriate personnel     |
|   |   | 1.3 | Identify and interpret relevant codes and standards   |
|   |   | 1.4 | Consult with appropriate personnel to ensure that work is coordinated effectively with others.  |
|   |   | 1.5 | Obtain equipment and resources needed for the task in accordance with enterprise procedures and check for correct operation and safety  |
| 2 | Design system   | 2.1 | Select the most suitable design for an industrial refrigeration system to meet the specified requirements                               |
|   |   | 2.2 | Plan design development work to meet scheduled timelines  |
|   |   | 2.3 | Check system design draft for compliance with the design brief, regulatory requirements and environmental standards                     |
| 3 | Analyse and adjust system performance   | 3.1 | Analyse system performance under variable conditions to client design brief and adjust component selection to meet performance criteria |
|   |   | 3.2 | Determine fulfilment of required capacity under full and partial load conditions using appropriate resources                            |

- |   |                        |     |  |
|---|------------------------|-----|--|
| 4 | Validate system design | 4.1 | Verify final design using enterprise procedures for compliance and regulatory requirements         |
|   |                        | 4.2 | Document final system design using appropriate equipment to industry standards for client approval |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting client requirements and specifications
- determining performance aspects of systems
- interpreting current refrigeration codes and regulations
- selecting of major system components and materials using manufacturer's data
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams with others

### Required knowledge

Required knowledge includes:

- standards and codes of practice
- design criteria
- moderate and low temperature industrial refrigeration systems
- multiple evaporators and multiple compressors
- indirect refrigeration systems
- flooded systems
- cryogenic systems
- basic control sequences

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li> <li>• demonstrate essential knowledge and skills relating to designing industrial refrigeration systems</li> <li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the design of industrial a refrigeration system consistently. The design must include standard manufactured components and piping, adherence to design specifications, documenting system design and compliance with safety and regulatory requirements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that</li> </ul>

	<p>competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>relevant legislation</li> <li>protective equipment</li> <li>material safety management systems</li> <li>hazardous substances and dangerous goods code</li> <li>local safe operation procedures</li> <li>awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>relevant legislation, regulations and codes</li> <li>correct handling and disposal of liquid and solid waste</li> <li>elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>dust elimination, minimisation and control</li> <li>minimisation of energy and water use</li> <li>elimination or control of excessive noise</li> <li>use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>leading hand</li> <li>foreman</li> <li>manager</li> </ul>

	<ul style="list-style-type: none"><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• scientific calculator</li><li>• technical charts and tables</li><li>• design brief</li><li>• suitable software</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li><li>• test apparatus</li><li>• appropriate tools of trade, equipment and materials</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.



# MEM23147A Contribute to the design of hydronic systems

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the knowledge and skills required to contribute to the design of hydronic systems or for less complex systems to undertake the complete design. The unit includes analysis of characteristics of water flow in a given pipework system; selection and sizing of pipes, fittings, suitable pumps, and associated fittings and valves.

## Application of the Unit

The unit applies to heating, ventilation, air conditioning and refrigeration (HVAC/R) technicians in manufacturing, servicing and maintenance enterprises required to undertake design work on hydronic systems. The unit applies to design work undertaken as part of a design team comprising engineers and other technicians and to individual design tasks within the technician's skill and knowledge.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23140A	Determine operational parameters for building HVAC/R hydronic systems

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Prepare design specification	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Identify the essential elements of a hydronic system to meet client design brief
		1.3	Consult with appropriate personnel to ensure that work is coordinated effectively with others
		1.4	Obtain equipment and resources needed for the task in accordance with enterprise procedures and check for correct operation and safety
2	Design system	2.1	Select a hydronic system design to meet the client requirements
		2.2	Plan design development work to meet scheduled timelines
		2.3	Check system design draft for compliance with the design brief, regulatory requirements and environmental standards
		2.4	Provide solutions to unplanned situations consistent with enterprise procedures
3	Analyse and adjust system performance	3.1	Apply knowledge of hydronic system operating parameters to analytical solutions to system design
		3.2	Analyse system performance under variable conditions and adjust component selection to meet performance criteria
		3.3	Determine fulfilment of required capacity under full and partial load conditions using appropriate resources

- |   |                        |     |  |
|---|------------------------|-----|--|
| 4 | Validate system design | 4.1 | Verify final design using enterprise procedures for compliance and regulatory requirements         |
|   |                        | 4.2 | Document final system design using appropriate equipment to industry standards for client approval |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting client requirements and specifications
- determine performance aspects of systems
- sizing pipes
- selecting optimum pump performance
- minimising system friction losses
- selecting major system components and materials using manufacturers data
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams with others

### Required knowledge

Required knowledge includes:

- principles of fluid flow
- pump performance and selection
- pipe sizes
- valve performance and selection
- pressure loss and static head calculations
- calculating system (static and dynamic) head
- optimum pump selection

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate essential knowledge and skills to design a hydronic system</li> <li>• demonstrate competence within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the design of a hydronic system consistently for different applications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include: <ul style="list-style-type: none"><li>• legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li></ul>
<b>Environmental requirements</b>	Environmental requirements include: <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li></ul>

	<ul style="list-style-type: none"> <li>• client</li> </ul>
<b>System operating parameters</b>	<p>System operating parameters include:</p> <ul style="list-style-type: none"> <li>• pump performance</li> <li>• system friction losses</li> <li>• pipe size</li> </ul>
<b>Resources</b>	<p>Resources may include:</p> <ul style="list-style-type: none"> <li>• manufacturer catalogues</li> <li>• fluids modelling software</li> <li>• scientific calculator</li> <li>• technical charts and tables</li> <li>• building plans</li> <li>• suitable software</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications and manuals</li> <li>• operational procedures</li> <li>• industry standards</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• computer workstation and software, either stand alone or networked</li> <li>• test apparatus</li> <li>• appropriate tools of trade, equipment and materials</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# MEM23148A Develop energy management solutions

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the skills and knowledge required to develop energy management solutions. This includes performing a complete energy audit of a large commercial or industrial building and making recommendations on reducing energy usage.

## Application of the Unit

The unit applies to heating, ventilation, air conditioning and refrigeration (HVAC/R) technicians who are required to investigate, advise and report on energy management solutions. As part of this work the technician may be required to conduct complete energy audits and model and validate solutions to improve energy use.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23142A	Apply psychrometric processes and system performance
MEM23143A	Apply energy management principles
MEM23154A	Analyse and service heating, ventilation, airconditioning and refrigeration control systems

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Prepare for an energy audit                  | 1.1 Obtain and implement work health and safety (WHS) and environmental requirements for a given work area              |
|   |  | 1.2 Determine procedure for completing an effective building energy audit   |
|   |  | 1.3 Collect data from building distribution diagrams and metering equipment   |
|   |  | 1.4 Ensure appropriate test equipment is maintained and is used correctly   |
|   |  | 1.5 Consult with appropriate personnel are to ensure that work is coordinated effectively with others                   |
|   |  | 1.6 Obtain equipment and resources needed for the task in accordance with enterprise procedures                         |
| 2 | Analyse data and prepare energy use profiles | 2.1 Select suitable energy simulation program for energy audit analysis using appropriate resources                     |
|   |  | 2.2 Analyse test data taking into consideration seasonal effects  |
|   |  | 2.3 Prepare building energy use profiles using appropriate equipment  |
|   |  | 2.4 Identify major energy consuming components, their likely profiles and total consumption using enterprise procedures |
| 3 | Model solutions                              | 3.1 Determine significant inputs of the simulated results   |



- 3.2 Model alternate energy profiles using appropriate equipment to evaluate various components of a building
- 3.3 Provide solutions to unplanned situations consistent with enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- monitoring data of a building management system (BMS)
- implementing energy management procedures for a building
- planning and conducting an energy audit
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- applying methods of energy conservation
- applying testing and data collection procedures
- determining electrical load control
- operating HVAC/R system control settings
- working in teams and with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

### Required knowledge

Required knowledge includes:

- energy usage within a multi-storey building, including major energy consuming plant
- criteria for determining selection and relevance of data for energy audits
- energy auditing process
- implementing energy management procedures for a building
- BMS attributes, such as functions, hardware, inputs and outputs
- contemporary methods in best practice in managing energy usage

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li> <li>• demonstrate essential knowledge and skills to carry out an energy audit of a building</li> <li>• demonstrate the competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate ability to develop performance energy management solutions using simulation software and make predictive reports. Competency must be demonstrated for different building sites.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred</li> </ul>

	<p>to other circumstances.</p> <ul style="list-style-type: none"> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> </ul>

	<ul style="list-style-type: none"><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• energy management software</li><li>• data from suitable building energy management systems</li><li>• seasonal variation data</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li><li>• test apparatus</li><li>• appropriate tools of trade, equipment and materials</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23149A Contribute to the design of commercial and industrial exhaust systems**

## **Modification History**

Release 1 (MEM05v9).

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to contribute to the design of commercial and industrial exhaust systems, including industrial dust extraction systems or for less complex systems to undertake the complete design.

## **Application of the Unit**

The unit applies to technicians in enterprises that design whole commercial and industrial exhaust systems or undertake design modifications to existing systems as part of manufacturing, installation, commissioning, servicing and maintenance activities.

The unit applies to design work undertaken as part of a design team comprising engineers and other technicians and to individual design tasks within the technician's skill and knowledge.

## **Licensing/Regulatory Information**

The following licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

MEM23004A                      Apply technical mathematics

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential                      Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Determine commercial and industrial exhaust system requirement	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Determine requirements for a commercial and industrial exhaust system using relevant standards, codes and authority information
		1.3	Consult appropriate personnel to ensure that work is coordinated effectively with others
		1.4	Obtain equipment and resources needed for the task in accordance with enterprise procedures
2	Design exhaust system	2.1	Prepare design and drawings for commercial and industrial system scenarios according to enterprise procedures
		2.2	Plan design development work to meet scheduled timelines
		2.3	Provide solutions to unplanned situations consistent with enterprise procedures
3	Document design	3.1	Validate specifications of exhaust system designed for meeting all relevant standards and codes for intended application
		3.2	Verify final design using enterprise procedures for compliance and regulatory requirements
		3.3	Prepare final system design documents to industry standards for client approval

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting requirements and specifications
- determining performance aspects of system
- applying noise abatement measures
- balancing fan duct systems
- using relevant drafting software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams with others

### Required knowledge

Required knowledge includes:

- relevant codes and regulations
- system types
- duct design
- fluid dynamics including laminar and turbulent flow, friction and pressure loss
- outlet design and location, including consideration of:
  - environmental requirements
  - noise
  - access protection against pests
- cycling/operation control
- dust collection and control, including:
  - filter types
  - cyclone and shaker type collectors
- motor ratings
- fan types
- noise control
- sound proofing
- flame proofing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li> <li>• demonstrate essential knowledge and skills to design commercial and industrial exhaust systems</li> <li>• demonstrate competence within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the ability prepare the design, drawings and specifications of a variety of exhaust systems. This must be demonstrated consistently on two (2) different systems</li> <li>• demonstrate the ability to design commercial and industrial exhaust systems consistent with codes and regulations. This must be demonstrated consistently on different systems.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of</li> </ul>



	<p>process.</p> <ul style="list-style-type: none"> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>legislation</li> <li>protective equipment</li> <li>material safety management systems</li> <li>hazardous substances and dangerous goods code</li> <li>local safe operation procedures</li> <li>awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>relevant legislation, regulations and codes</li> <li>correct handling and disposal of liquid and solid waste</li> <li>elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>dust elimination, minimisation and control</li> <li>minimisation of energy and water use</li> <li>elimination or control of excessive noise</li> <li>use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>supervisor</li> <li>leading hand</li> </ul>

	<ul style="list-style-type: none"> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Commercial and industrial exhaust system</b>	<p>An enterprise system could be inclusive of any or all of the following:</p> <ul style="list-style-type: none"> <li>• dust</li> <li>• fumes</li> <li>• explosive gases</li> <li>• noxious gases</li> </ul>
<b>Resources</b>	<p>Resources may include:</p> <ul style="list-style-type: none"> <li>• relevant codes and manufacturer specifications</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> <li>• industry standards</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• computer workstation and software, either stand alone or networked</li> <li>• test apparatus</li> <li>• appropriate tools of trade, equipment and materials</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.

# MEM23150A Contribute to the design of heating systems

## Modification History

Release 1 (MEM05v9).

## Unit Descriptor

This unit of competency covers the skills and knowledge required to contribute to the design of appropriate heating equipment to provide optimum performance or for less complex systems to undertake the complete design. The unit includes determination of best piping configurations and system pipe sizes, taking into account thermal heat losses.

## Application of the Unit

The unit applies to manufacturing, servicing and maintenance enterprises incorporating refrigeration and air conditioning design, manufacture and installation.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23140A	Determine operational parameters for building HVAC/R hydronic systems
MEM23147A	Contribute to the design of hydronic systems

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                               |  |
|---|-------------------------------|--|
| 1 | Prepare design specifications | 1.1 Obtain and implement work health and safety (WHS) and environmental requirements for a given work area                                   |
|   |                               | 1.2 Identify the essential elements of a heating system to meet client design brief  |
|   |                               | 1.3 Consult appropriate personnel to ensure that work is coordinated effectively with others   |
|   |                               | 1.4 Obtain equipment and resources needed for the task in accordance with enterprise procedures and check for correct operation and safety   |
|   |                               |  |
| 2 | Design system                 | 2.1 Select a heating system design to meet the client requirements   |
|   |                               | 2.2 Plan design development work to meet scheduled timelines   |
|   |                               | 2.3 Check system design draft for compliance with the design brief, regulatory requirements and environmental standards                      |
|   |                               | 2.4 Calculate heating loads and matching heating capacity  |
|   |                               | 2.5 Select appropriate heating equipment to satisfy design specifications  |
|   |                               | 2.6 Provide solutions to unplanned situations consistent with enterprise procedures  |
|   |                               | 2.7 Document method of capacity rating and sizing for each discrete component in the system to industry standard using enterprise procedures |

3	Analyse system and adjust system performance	3.1	Evaluate system performance under variable conditions
		3.2	Adjust component selection where required to meet heating system performance criteria
		3.3	Determine fulfilment of required heating capacity under full and partial load conditions
4	Validate final design	4.1	Verify final design using enterprise procedures for compliance and regulatory requirements
		4.2	Document final system design according to industry standards and enterprise procedures for client approval

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting client requirements and specifications
- determining performance aspects of systems
- sizing pipes
- minimising system heat losses
- selecting major system components and materials using manufacturers data
- selecting appropriate heating equipment
- evaluating piping configuration
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams and with others

### Required knowledge

Required knowledge includes:

- heating techniques, including relative advantages and disadvantages of:
  - heat pumps
  - boilers and hydronic systems, including underfloor systems
  - gas
  - electric
  - solar
  - solid fuel
- system configuration
- piping configuration, including:
  - standard materials and sizes
  - sources of information (e.g. catalogues)
- system pipe sizes
- WHS and environmental requirements relevant to heating systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li> <li>• demonstrate essential knowledge and skills to design heating systems</li> <li>• demonstrate competence within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate the design of a heating system consistently for different applications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>

<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> </ul>



	<ul style="list-style-type: none"><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• scientific calculator</li><li>• componentry catalogues</li><li>• technical charts and tables</li><li>• design brief</li><li>• suitable software</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry procedures</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li><li>• test apparatus</li><li>• appropriate tools of trade, equipment and materials</li></ul>

<b>Heating equipment</b>	Heating equipment may include: <ul style="list-style-type: none"><li>• heat pumps</li><li>• boilers</li><li>• coils</li><li>• expansion tanks</li><li>• pumps</li><li>• control valves</li><li>• air purge points</li><li>• water treatment</li><li>• pipe anchors and expansion joints</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**      Engineering science

## Custom Content Section

Not applicable.

# MEM23151A Commission and optimise performance of HVACR systems

## Modification History

Release 1 (MEM05v9)

## Unit Descriptor

This unit of competency covers the skills and knowledge required to commission and optimise a heating, ventilation, air conditioning and refrigeration (HVAC/R) system and associated plant and equipment.

## Application of the Unit

The unit applies to HVAC/R technicians in manufacturing, servicing and maintenance enterprises who are required to commission HVAC/R systems, and as part of the commissioning process, ensure optimal performance.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23006A	Apply fluid and thermodynamics principles in engineering
MEM23154A	Analyse and service HVAC/R control systems
MEM23140A	Determine operational parameters for building HVAC hydronic systems

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Prepare HVAC/R system for commissioning        | 1.1 Obtain and implement work health and safety (WHS) and environmental requirements for a given work area   |
|   |  | 1.2 Determine system operating parameters by reviewing system specifications and component technical data  |
|   |  | 1.3 Identify correct building codes and local government regulations using appropriate resources   |
|   |  | 1.4 Prepare industry standard report on system performance levels using enterprise procedures  |
|   |  | 1.5 Consult appropriate personnel to ensure the work is coordinated effectively with others involved on the work site  |
|   |  | 1.6 Obtain equipment, resources and testing devices needed for the work in accordance with enterprise procedures   |
| 2 | Commission and optimise complex HVAC/R systems | 2.1 Set up and connect testing and measuring devices appropriately for task and to manufacturer specifications   |
|   |  | 2.2 Measure and adjust equipment components and controls, as required  |
|   |  | 2.3 Undertake required measurements and tests and analyse results to provide optimum system performance in accordance with system specifications and regulatory requirements |
|   |  | 2.4 Provide solutions to unplanned situations consistent with enterprise procedures  |
|   |  | 2.5 Ensure commissioning is carried out efficiently without waste of materials or damage to equipment and surroundings   |

- |   |  |     |  |
|---|--|-----|--|
| 3 | Complete and report commissioning activities | 3.1 | Verify that plant and equipment are operating to specification   |
|   |  | 3.2 | Document adjustment settings and notify appropriate personnel in accordance with enterprise procedures |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting commissioning requirements and system specifications
- determining performance aspects of system
- using appropriate test equipment effectively
- devising a commissioning schedule and plan
- setting up commissioning tests and documenting them
- interpreting drawings and specifications
- communicating effectively with others involved in the commissioning task
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams and with others

### Required knowledge

Required knowledge includes:

- fundamentals of HVAC/R systems, including:
  - air systems
  - hydronic systems
  - control systems
  - chillers
  - boilers and furnaces
  - cooling towers
  - heat exchangers
  - piping
  - ducts
- plant and equipment commissioning techniques and procedures, including:
  - set up

- measuring and testing
- fault-finding
- adjustments
- reporting and documenting
- commissioning schedules

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li><li>• demonstrate essential knowledge and skills to commission a HVAC/R system</li><li>• demonstrate competence within a timeframe typically expected of the discipline, work function and industrial environment</li><li>• demonstrate commissioning of HVAC/R systems consistently. This includes:<ul style="list-style-type: none"><li>• identifying system design operating parameters</li><li>• measuring and adjusting system components and controls to provide optimum system performance</li><li>• ensuring system operates within regulatory requirements</li><li>• documenting adjustment settings with established procedures.</li></ul></li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li><li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering</li></ul>

	<p>Training Package.</p> <ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> </ul>

	<ul style="list-style-type: none"><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Plant and equipment</b>	Plant and equipment may include: <ul style="list-style-type: none"><li>• control system</li><li>• chiller</li><li>• boiler</li><li>• cooling tower</li><li>• heat exchanger</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• reference manuals</li><li>• scientific calculator</li><li>• appropriate manuals</li><li>• stationery</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand</li></ul>



	<p>alone or networked</p> <ul style="list-style-type: none"><li>• test apparatus</li><li>• appropriate tools of trade, equipment and materials</li></ul>
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## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# **MEM23152A Apply principles of refrigeration food storage technology**

## **Modification History**

Release 1 (MEM05v9)

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to recognise common causes of food spoilage and apply the optimum methods for commercial food preservation processes.

## **Application of the Unit**

The unit applies to manufacturing, servicing and maintenance enterprises incorporating refrigeration and air conditioning design, manufacture and installation.

## **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Recognise causes of food spoilage	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Determine causes of food spoilage from observation, testing, measurements and/or supply chain tracking
		1.3	Interpret and apply relevant Australian standards, codes and regulations for food storage and handling
		1.4	Consult appropriate personnel to ensure that work is coordinated effectively with others
		1.5	Obtain equipment and resources needed for the task in accordance with enterprise procedures
2	Analyse food spoilage risks in supply chain	2.1	Identify critical points in the food supply chain and determine the associated risks
		2.2	Identify and document risks and propose appropriate risk minimisation strategies
		2.3	Check proposed risk minimisation strategies against relevant standards, codes and legislative requirements
		2.4	Provide solutions to unplanned situations consistent with enterprise procedures
3	Select optimum methods storage of perishable food	3.1	Propose options to minimise food spoilage based on analysis of the produce type, facilities available and supply chain requirements
		3.2	Select optimum solutions with respect to equipment, facilities, processing techniques and cost, and discuss with appropriate personnel
		3.3	Document adopted storage and handling method in accordance with enterprise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- controlling and managing risks associated with food storage
- identifying relevant codes, standards and regulations and applying compliance procedures
- determining main reasons for food spoilage
- preventing food spoilage through microorganisms
- complying with relevant legislative and regulatory requirements
- communicating effectively with others
- documenting findings, plans and recommendations
- dealing effectively with unexpected situations
- working in teams and with others

## Required knowledge

Required knowledge includes:

- codes, standards and regulations relevant to refrigerated food storage
- food spoilage and possible causes
- food preservation equipment and techniques
- microorganisms relevant to food safety and preservation
- types of heat processing techniques
- types of chilling processing techniques
- cold storage chain
- controlled atmosphere storage
- refrigerant choices
- energy usage
- refrigeration plant
- insulation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li><li>• demonstrate essential knowledge and skills of principles of refrigeration and storage technology</li></ul>
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	<ul style="list-style-type: none"> <li>demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>demonstrate the ability to apply principles of refrigeration food storage technology consistently in different contexts.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work

environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include: <ul style="list-style-type: none"><li>• relevant legislation</li><li>• protective equipment</li><li>• material safety management systems</li><li>• hazardous substances and dangerous goods code</li><li>• local safe operation procedures</li><li>• awards provisions</li></ul>
<b>Environmental requirements</b>	Environmental requirements include: <ul style="list-style-type: none"><li>• relevant legislation, regulations and codes</li><li>• correct handling and disposal of liquid and solid waste</li><li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li><li>• dust elimination, minimisation and control</li><li>• minimisation of energy and water use</li><li>• elimination or control of excessive noise</li><li>• use and recycling of refrigerants</li></ul>
<b>Appropriate personnel</b>	Appropriate personnel may include: <ul style="list-style-type: none"><li>• supervisor</li><li>• leading hand</li><li>• foreman</li><li>• manager</li><li>• engineer</li><li>• technician</li><li>• trainer</li><li>• mentor</li><li>• team member</li><li>• customer</li><li>• client</li></ul>
<b>Food spoilage</b>	Food spoilage may include: <ul style="list-style-type: none"><li>• physical damage</li><li>• animal damage</li><li>• chemical breakdown</li><li>• enzyme activity</li><li>• microorganisms</li><li>• effects of:</li></ul>

	<ul style="list-style-type: none"><li>• temperature change</li><li>• humidity change</li><li>• freezing on fresh produce</li><li>• slow freezing time</li><li>• refreezing</li></ul>
<b>Enterprise procedures</b>	Enterprise procedures may include: <ul style="list-style-type: none"><li>• the use of tools and equipment</li><li>• instructions, including job sheets, plans, drawings and designs</li><li>• reporting and communication</li><li>• manufacturer specifications</li><li>• operational procedures</li><li>• industry standards</li></ul>
<b>Resources</b>	Resources may include: <ul style="list-style-type: none"><li>• reference manuals/data sheets</li><li>• scientific calculator</li><li>• stationery</li><li>• access to relevant standards, codes, laws and by-laws</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li><li>• chemical analysers</li><li>• measurement instruments (e.g. thermometers and probes)</li><li>• hand tools</li></ul>
<b>Processing techniques</b>	Processing techniques may include: <ul style="list-style-type: none"><li>• heat processing techniques, such as blanching, pasteurisation, sterilisation, evaporation, dehydration, baking and roasting, steam and water</li><li>• chilling processing techniques, such as freezing, freeze drying and freeze concentration, cryovac, and controlled atmosphere</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering science

## Custom Content Section

Not applicable.



# MEM23153A Contribute to the design of heat exchanger systems

## Modification History

Release 1 (MEM05v9)

## Unit Descriptor

This unit of competency covers the skills and knowledge required to contribute to the design of heat exchanger systems or for less complex systems to undertake the complete design.

## Application of the Unit

The unit applies to heating, ventilation, air conditioning and refrigeration (HVAC/R) technicians in manufacturing, servicing and maintenance enterprises who are required to undertake design work on heat exchangers. The unit applies to design work undertaken as part of a design team comprising engineers and other technicians and to individual design tasks within the technician's skill and knowledge.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

MEM23004A Apply technical mathematics

MEM23006A Apply fluid and thermodynamics principles in engineering

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Establish requirements for heat exchanger design	1.1	Obtain and implement work health and safety (WHS) and environmental requirements for a given work area
		1.2	Determine the extent of the design from design briefs, reports and in consultations with appropriate personnel
		1.3	Determine and interpret relevant standards, codes or regulations applicable to the design
		1.4	Consult appropriate personnel to ensure that work is coordinated effectively with others
		1.5	Obtain equipment and resources needed for the task in accordance with enterprise procedures
2	Determine specifications for heat exchanger design	2.1	Obtain parameters and performance requirements in relation to refrigeration system
		2.2	Model design solutions based on developed heat exchanger specifications to determine the most effective solution
		2.3	Establish final selection on heat exchanger design in consultation with appropriate personnel
		2.4	Provide solutions to unplanned situations consistent with enterprise procedures
3	Document heat exchanger design	3.1	Document design, including all details of findings, calculations and assumptions in accordance with enterprise procedures
		3.2	Notify appropriate personnel about the completion of the design task

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- interpreting client requirements and specifications
- determining performance aspects of heat exchanger
- interpreting current codes and regulations
- selecting major system components and materials using manufacturer's data
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- communicating technical and procedural requirements to others
- documenting technical information and designs
- dealing effectively with unexpected situations
- working in teams and with others

## Required knowledge

Required knowledge includes:

- thermodynamic principles
- heat transfer
- refrigeration/heat pump parameters
- airflow parameters and measurement of airflow
- calorimetric measurements
- measurement of temperature

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• implement WHS workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range</li><li>• demonstrate essential knowledge and skills to design heat exchanger systems</li><li>• demonstrate competency within a timeframe typically expected of the discipline, work function and industrial environment</li><li>• demonstrate the design of heat exchanger systems</li></ul>
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	consistently.
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	WHS requirements include:
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	<ul style="list-style-type: none"> <li>• relevant legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> <li>• use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Resources</b>	<p>Resources may include:</p> <ul style="list-style-type: none"> <li>• data sheets</li> <li>• appropriate modelling software</li> <li>• manuals and tables</li> <li>• stationery</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications</li> <li>• operational procedures</li> </ul>

	<ul style="list-style-type: none"><li>• industry standards</li></ul>
<b>Equipment</b>	Equipment may include: <ul style="list-style-type: none"><li>• computer workstation and software, either stand alone or networked</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

# MEM23154A Analyse and service HVACR systems

## Modification History

Release 1 (MEM05v9)

## Unit Descriptor

This unit of competency covers the skills and knowledge required to analyse and evaluate heating, ventilation, air conditioning and refrigeration (HVAC/R) control system requirements for a specific application.

This includes evaluation of existing automatic control systems; interpreting and producing control diagrams; commissioning, fault-finding and repairing a HVAC/R control system.

## Application of the Unit

The unit applies to HVAC/R technicians in manufacturing, servicing and maintenance enterprises. The unit applies to existing HVAC/R control systems and does not cover the design of new HVAC/R systems.

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEM23004A                      Apply technical mathematics

MEM23006A                      Apply fluid and thermodynamics principles in engineering

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential

Performance criteria describe the performance needed

outcomes of a unit of competency. to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                       |     |   |
|---|---------------------------------------|-----|---|
| 1 | Prepare for analysis and service task | 1.1 | Obtain and implement work health and safety (WHS) and environmental requirements for a given work area  |
|   |                                       | 1.2 | Identify essential elements of a control system   |
|   |                                       | 1.3 | Determine the function of electrical, pneumatic and electronic control and flow devices using control circuit diagrams and/or specifications or other specialised resources |
|   |                                       | 1.4 | Obtain sequence of control, specify settings and adjust control devices from system's specifications  |
|   |                                       | 1.5 | Consult appropriate personnel to ensure that work is coordinated effectively with others  |
|   |                                       | 1.6 | Obtain equipment and resources needed for the task in accordance with enterprise procedures and check for correct operation and safety                                      |
| 2 | Analyse performance of control system | 2.1 | Identify HVAC/R system operating parameters and system features   |
|   |                                       | 2.2 | Use appropriate equipment and HVAC/R energy management principles to evaluate the operating economy of the system   |
|   |                                       | 2.3 | Produce control diagrams according to applicable standards and practices  |
|   |                                       | 2.4 | Report analysis to appropriate personnel and establish appropriate action to be taken based on findings   |
| 3 | Adjust and service control system     | 3.1 | Confirm plant control compliance with desired conditions through appropriate measurements and recordings of system performance  |
|   |                                       | 3.2 | Adjust system to required specification   |



- |   |  |   |
|---|--|---|
|   | 3.3  | Isolate, replace or repair components not performing to specification   |
|   | 3.4  | Arrange appropriate tests and measurements on an electrically live system in accordance with WHS and regulatory requirements  |
|   | 3.5  | Provide solutions to unplanned situations consistent with enterprise procedures   |
| 4 | Make recommendations to improve the performance of plant | <p>4.1 Document analysis, including details of all findings, calculations and assumptions</p> <p>4.2 Prepare recommendations on control system modifications and discuss with appropriate personnel</p> <p>4.3 Ensure work area is cleaned and made safe in accordance with enterprise procedures</p> |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting standards, codes and regulations relevant to HVAC/R control systems
- producing control diagrams
- evaluating automatic control systems
- determining control requirements, including:
  - full and partial load performance requirements
  - automated and manual control sequences
  - integration with energy management system requirements
- commissioning control systems
- using relevant software tools effectively
- interpreting drawings and specifications
- communicating effectively with others
- working in teams and with others
- communicating technical and procedural requirements to others
- dealing effectively with unexpected situations

## Required knowledge

Required knowledge includes:

- thermodynamic principles relevant to HVAC/R controls
- control fundamentals
- types of control equipment, including microprocessors, sensors, and so on
- direct data control (DDC) systems
- supervisory control systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• implement WHS workplace procedures and practices, including the use of risk control measures</li> <li>• demonstrate essential knowledge and skills to analyse and service HVAC/R control systems</li> <li>• demonstrate the competency within a timeframe typically expected of the discipline, work function and industrial environment</li> <li>• demonstrate analysing and servicing HVAC/R control systems consistently in different applications.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> </ul>

	<ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>WHS requirements</b>	<p>WHS requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation</li> <li>• protective equipment</li> <li>• material safety management systems</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operation procedures</li> <li>• awards provisions</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements include:</p> <ul style="list-style-type: none"> <li>• relevant legislation, regulations and codes</li> <li>• correct handling and disposal of liquid and solid waste</li> <li>• elimination or minimisation of gas, fume, vapour and smoke emissions, including fugitive emissions</li> <li>• dust elimination, minimisation and control</li> <li>• minimisation of energy and water use</li> <li>• elimination or control of excessive noise</li> </ul>

	<ul style="list-style-type: none"> <li>• use and recycling of refrigerants</li> </ul>
<b>Appropriate personnel</b>	<p>Appropriate personnel may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• manager</li> <li>• engineer</li> <li>• technician</li> <li>• trainer</li> <li>• mentor</li> <li>• team member</li> <li>• customer</li> <li>• client</li> </ul>
<b>Resources</b>	<p>Resources may include:</p> <ul style="list-style-type: none"> <li>• reference manuals</li> <li>• scientific calculator</li> <li>• appropriate manuals</li> <li>• stationery</li> <li>• suitable computer software</li> </ul>
<b>Enterprise procedures</b>	<p>Enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• operational procedures</li> <li>• industry standards</li> </ul>
<b>Equipment</b>	<p>Equipment may include:</p> <ul style="list-style-type: none"> <li>• computer workstation and software, either stand alone or networked</li> <li>• appropriate tools</li> <li>• appropriate spare parts</li> <li>• cables and connectors</li> <li>• test equipment</li> <li>• consumables</li> <li>• appropriate software licences</li> <li>• manufacturer specifications and manuals</li> <li>• diagnostics software</li> <li>• personal computer</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

# **MEM234001A Plan and manage engineering-related projects or operations**

## **Modification History**

Release 2 - Replacement of text missing from Element 3 PCs. Equivalent.

## **Unit Descriptor**

This unit of competency covers the skills associated with high level planning and management of engineering-related projects or operations. The unit covers the skills required to plan, establish, maintain and manage complex engineering systems and resources associated with time-defined engineering-related projects or high level engineering operations management in a manufacturing or engineering-related organisation.

## **Application of the Unit**

This unit applies to the planning and management of engineering-related projects or operations. Activities include significant project or operations management responsibilities and may require personal and electronic communication, self-directed and group activities, business planning, project or operations planning and scheduling, and an understanding of the technology, skills and techniques, and quality aspects required by the project or operations.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Establish parameters for project or operations management | 1.1 | Establish budget and control measures for project or operations to conform to the business plan   |
|   |   | 1.2 | Prepare project or operations management plan to conform with the business plan   |
|   |   | 1.3 | Establish procurement requirements  |
|   |   | 1.4 | Establish the need and provide for appropriate technical and professional assistance  |
|   |   | 1.5 | Establish physical resources requirements   |
|   |   | 1.6 | Establish human resources and skills development requirements   |
|   |   | 1.7 | Establish compliance and environmental requirements for project or operation, including occupational health and safety (OHS) requirements, codes of practice, regulations, standards and other regulatory requirements, and enterprise procedures |
|   |   | 1.8 | Carry out required project and operations modelling and calculations using appropriate modelling and analysis software  |
|   |   |     |   |
| 2 | Implement project or operations management plan           | 2.1 | Select an appropriate team and establish communication and cooperation within the team  |
|   |   | 2.2 | Review and agree on plans, schedules and requirements with the team, assign responsibilities within the team, and establish other functional groups and expert support, as required   |
|   |   | 2.3 | Determine internal and external reporting requirements, including content, regulatory compliance, schedule and sign-off arrangements  |
|   |   | 2.4 | Establish suppliers, contractors and delivery schedules   |
|   |   | 2.5 | Arrange for any required recruitment and training of employees  |

- |   |  |     |   |
|---|--|-----|---|
| 3 | Monitor and review accountability for project or operations implementation | 3.1 | Monitor, review and maintain records of operations or project for accountability against the project objectives, and schedule and cost budget, including required quality outcomes  |
|   |  | 3.2 | Monitor, review and maintain records of regulatory compliance, including enterprise agreements or awards, OHS, codes of practice and other legislative requirements, environmental and social obligations, and ethical practice |
|   |  | 3.3 | Maintain records of professional, trades and industry contacts, sources of information and resources used in the implementation of the project or operation   |
|   |  | 3.4 | Establish, monitor and review a schedule of procurement requirements and associated contracts and any installation requirements   |
|   |  |     |   |
| 4 | Manage progress of implementation  | 4.1 | Establish mechanisms to manage constraints and contingencies, including coordination with team members, project stakeholders and contractors  |
|   |  | 4.2 | Adjust short-term planning and schedules, as required   |
|   |  | 4.3 | Manage technical support, specialist and professionals services to meet schedules, budgets and quality and performance requirements   |
|   |  | 4.4 | Apply principles of continuous improvement to implementation  |
|   |  | 4.5 | Document the project outcomes against the project requirements, as required   |
|   |  | 4.6 | Supervise the completion of project, including sign-off and completion of required documentation of the project, as required  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.



## Required skills

Required skills include:

- ensuring project or operations activities are accurately identified and implemented in priority order in accordance with implementation schedules
- investigating and validating the suitability of performance analysis, modelling and simulation software
- identifying potential implications for the project or operation from non-engineering contexts, including:
  - competitive environment for the organisation
  - customer and supplier relationships
  - labour and skill supply and demand
  - industrial relations
  - regulatory environment
- managing complex engineering-related projects and operations
- managing the interrelationships between concurrent engineering techniques, electronic data control and supervisory systems
- managing roles, responsibilities and levels of authority, and delegating, as appropriate, to team members and in accordance with project and operation schedules
- evaluating projects and operations for feasibility against business plan, including relevant engineering and financial calculations and analysis
- communicating, negotiating and reviewing actions with relevant stakeholders and team members

## Required knowledge

Required knowledge includes:

- personal authorities and priorities for projects or operations
- current options and trends in performance analysis, project and financial modelling, engineering-related modelling and simulation software, including underpinning program and software validation techniques
- budget and control measurement and analysis techniques for project or operations management
- project plan and schedule from project design activities
- physical resource availability for project or operations
- human resource/skills availability for engineering-related projects
- accountability – audit, recording and implementation requirements for projects or operations, such as tenders, contracts, schedules, budgets, personnel and resource allocations, and financial management procedures and standard operating procedures, including maintenance procedures
- technical documentation management, graphics and specifications and records of meetings, communications, negotiations, and decisions and agreements with stakeholders

- sources of information and resources, including:
  - professional services
  - finance
  - accounts
  - taxation
  - legal
  - insurance
  - human resources
  - trade and industry contacts
- contemporary contingency and constraints management approaches
- implications for engineering projects or operations associated with typical financial planning and accounting processes which may relate to an engineering project or operation such as:
  - capital flow and liquidity
  - assets and liabilities
  - depreciation
  - balance sheet
  - costing
  - budgeting and cost control
  - break-even analysis
  - profit and loss
  - capital investment and return on investment
  - financial record keeping procedures for expenditures
- typical legal requirements for engineering-related projects or operations
- OHS requirements, codes of practice, regulations, standards and regulatory requirements for project or operations
- risk management and reduction, current safe work methods statements, material safety data sheets (MSDS) and work permits
- professional and ethical practice
- tendering and contracts requirements and processes, including agreement on design and specification, negotiations and optimisations, provisions for variations, delays and penalties
- work organisation and management theory
- conflict resolution, problem solving and decision making

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for	Assessors must be satisfied that the candidate can competently and
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assessment and evidence required to demonstrate competency in this unit	<p>consistently:</p> <ul style="list-style-type: none"> <li>• identify, plan and establish engineering and organisation requirements for the project or operation</li> <li>• establish resources required, including labour, materials, equipment within budgets, and procedures</li> <li>• investigate and validate performance analysis, modelling and simulation software</li> <li>• commence project or operation management, including establishing support team and responsibilities</li> <li>• overcome constraints and contingencies to achieve schedules and budgets as contained in business plan</li> <li>• undertake appropriate internal and external reporting</li> <li>• manage continuous improvement.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, or a combination of both on and off the job assessment based on appropriate project and simulation activities. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate

	and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering-related projects or operation</b>	<p>Engineering-related projects or operations may occur in a wide variety of industries, for example:</p> <ul style="list-style-type: none"> <li>• manufacturing</li> <li>• defence</li> <li>• transport and logistics</li> <li>• health</li> <li>• utilities</li> </ul> <p>The distinguishing feature for the engineering-related project or operation, as it applies to this unit, is that the project or operations management requires high level para-professional engineering skills in an established engineering discipline or area</p>
<b>Business plan</b>	<p>Business plan means a plan for either a time-defined project or an ongoing engineering-related operation that:</p> <ul style="list-style-type: none"> <li>• is approved by the client or management of the organisation</li> <li>• contains budgets and which has financial and performance targets</li> <li>• specifies a project or operational schedule</li> <li>• specifies stakeholder reporting/approval mechanisms and degree of autonomy for decision making</li> <li>• specifies any legal requirements or other resources available or required to be established</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, for example: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring or devices with high current or voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as:</li> </ul>

	<ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> <li>• professional services for: <ul style="list-style-type: none"> <li>• finance, accounts and tax</li> <li>• insurance and legal</li> <li>• training and human resources (HR)</li> </ul> </li> </ul>
<b>OHS requirements, codes of practice, regulatory requirements and enterprise procedures</b>	<p>OHS, codes of practice, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Appropriate modelling and analysis software</b>	<p>Appropriate modelling and analysis software may include:</p> <ul style="list-style-type: none"> <li>• project tracking</li> <li>• financial modelling, analysis and tracking</li> <li>• process modelling and analysis</li> <li>• engineering simulation and modelling</li> <li>• manufacturing operation simulation</li> </ul>
<b>Records of operations or project</b>	<p>Records of operations include:</p> <ul style="list-style-type: none"> <li>• tenders, contracts and schedule</li> <li>• personnel, resource allocations and financial management procedures</li> <li>• standard operating procedures, including maintenance procedures</li> <li>• OHS committee minutes and actions</li> <li>• risk management and mitigation</li> <li>• documentation and records of current safe work methods statements</li> <li>• MSDS, work permits, standards and codes of practice</li> <li>• Audits</li> <li>• Meetings and communications</li> <li>• graphics and specifications</li> </ul>

<b>Manage constraints and contingencies</b>	<p>Contingencies arising during operations or improvement projects are responded to in the context of constraints. Contingencies may threaten operations or improvement projects and planning for contingencies may be essential to maintain resources, skilled labour and schedules. Each contingency will have constraints on possible solutions. These may be:</p> <ul style="list-style-type: none"><li>• financial, organisation procedural or culture constraints</li><li>• physical constraints, such as limits to resources, limits to site access or logistical limitations</li></ul>
<b>Legislative requirements</b>	<p>Legislative requirements may include:</p> <ul style="list-style-type: none"><li>• industrial law and awards</li><li>• customer protection law</li><li>• restrictive trade practice</li><li>• environmental protection</li><li>• workers compensation</li><li>• equality and anti-discrimination</li><li>• contract law</li></ul>
<b>Continuous improvement</b>	<p>Continuous improvement may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Improvement processes may include techniques such as:</p> <ul style="list-style-type: none"><li>• balanced scorecard</li><li>• current and future state mapping</li><li>• measuring performance against benchmarks</li><li>• process improvement, problem solving and decision making</li><li>• data management, generation, recording, analysing, storing and use of software</li><li>• training for improvement systems participation</li><li>• technical training</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## **MEM234002A Integrate engineering technologies**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the skills required to integrate technologies, processes, components or equipment for projects or operations. Apart from engineering considerations the unit encompasses sustainability, occupational health and safety (OHS) and regulatory requirements and implications of the project.

### **Application of the Unit**

This unit applies to individuals working as a Principal Technical Officer or in an equivalent engineering-related position who are required to integrate different technologies, processes, components or equipment. The unit applies to all forms of manufacturing and engineering operations. It is suitable for persons with system design, installation, commissioning and project or operational management responsibilities who have to integrate different technologies. The technologies may be all in one discipline or technical field or across engineering and related disciplines. For installation, commissioning and project or operational management application, the unit assumes that discretion as to the type and level of integration applies and the actual level of integration must be determined.

Prior or concurrently developed experience in the application of scientific principles, mathematics, materials, manufacturing processes, computer software for computer-aided design (CAD), system analysis, modelling and simulation, project work and risk management and experience in the technologies to be integrated is required.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Clarify the scope of the integration design task and elaborate the specification     | 1.1 Identify processes, machine, equipment, components and technologies covered by integration task<br>1.2 Determine other parameters to the integration task<br>1.3 Determine stakeholders to be consulted<br>1.4 Determine if and when input and advice should be obtained from experts in other technical fields and disciplines<br>1.5 Assess OHS, regulatory, sustainability or environmental issues relevant to integration task<br>1.6 Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility  |
| 2 | Prepare integration analysis and concept proposal for designs or operational changes | 2.1 Carry out initial investigations into technologies and equipment to be integrated<br>2.2 Identify any existing or pre-designed integration<br>2.3 Determine any special features of machines, equipment or processes that need to be considered<br>2.4 Carry out required analysis, modelling and calculations using appropriate software and validation techniques<br>2.5 Obtain design or advice from experts in other technical fields and disciplines, if required<br>2.6 Generate a range of integration solutions<br>2.7 Check feasibility and evaluate solutions against design criteria, project brief or operating specifications ensuring |



- |   |  |   |
|---|--|---|
|   |  | conformity to technical, economic and OHS requirements  |
|   | 2.8  | Determine social and sustainability implications of solutions   |
|   | 2.9  | Present integration concept proposals to client or supervisors  |
| 3 | Finalise integration strategy                          | 3.1 Evaluate concept proposals with client<br>3.2 Finalise selected integration strategy, including design elements or modifications and implementation strategy, ensuring preparation of all required documentation, drawings, specifications and instructions<br>3.3 Consult with client and stakeholders to obtain sign-off on integration strategy and documentation  |
| 4 | Implement integrated engineering technologies strategy | 4.1 Monitor and support prototyping or testing of machine, process or technology using selected integrated engineering strategy<br>4.2 Analyse performance against strategy and internal or external client specifications<br>4.3 Adjust strategy, as required<br>4.4 Obtain sign-off and oversight production of adjusted documentation, drawings, specifications and instructions<br>4.5 Communicate and negotiate with stakeholders to address issues such as design and resources adjustments<br>4.6 Ensure design and implementation documentation and records are maintained in accordance with organisational requirements |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- interpreting features of machines or equipment
- establishing parameters to the brief or contract, including extent to which integration task goes beyond own technical field
- communicating and negotiating with client and stakeholders
- generating a range of solutions, including the technical requirements of an implementation plan
- applying design standards, performance analysis, and modelling and simulation software
- validating software
- evaluating solutions for feasibility against design criteria
- developing and optimising chosen solution and technical implementation plan and schedule
- preparing proposals, including the implementation plan, resource requirements, documents, specifications, graphics and instructions
- monitoring and supporting implementation
- commissioning the project or operation

## Required knowledge

Required knowledge includes:

- design, implementation, commissioning and troubleshooting process
- technology requirements for integration task
- holistic engineering principles, such as systems thinking, design, research and investigations methods
- modelling and calculation techniques
- current options and trends in design, performance analysis, and modelling and simulation software
- software validation techniques
- design and implementation criteria
- critical activities and resources as input to the planning process
- planning and scheduling techniques
- requirements for sign-off
- documentation, drawings, specifications and instructions required
- OHS and regulatory requirements, codes of practice, standards and registration requirements

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine the scope of the integration task</li> <li>• establish parameters to the integration task</li> <li>• communicate and negotiate with client and stakeholders</li> <li>• generate a range of solutions, including the technical requirements of an implementation plan, using systems thinking, innovation and creativity</li> <li>• apply design standards, performance analysis, modelling and simulation software</li> <li>• validate software</li> <li>• evaluate solutions for feasibility against design criteria</li> <li>• develop and optimise chosen solution and technical implementation plan and schedule</li> <li>• prepare proposals, including the implementation plan, resource requirements, documents, specifications, graphics and instructions</li> <li>• monitor and support implementation</li> <li>• commission the project or operation.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency</li> </ul>

	<p>is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Integration task</b>	<p>For the purposes of this unit, an integration task has the following features:</p> <ul style="list-style-type: none"> <li>the integration must require application of engineering skill and knowledge across a range of engineering technologies and systems. The integration task may or may not go across disciplines or technical fields of work</li> <li>the integration must not already be fully pre-designed</li> <li>integration may be required across one or more processes, machines and sets of equipment</li> </ul> <p>Typical integration tasks would be those requiring integration of mechanical, fluid power and electrical systems with control technologies, structural support, and other engineering-related systems as may be found in automated applications</p>
<b>Parameters to the integration brief</b>	<p>Parameters to the integration brief include:</p> <ul style="list-style-type: none"> <li>technology and process limits</li> <li>capital and design budgets</li> <li>product cost limits and budgets</li> <li>anticipated post-integration performance specifications</li> <li>equipment availability, capacities and restrictions</li> <li>specified administrative, communication and approval procedures</li> <li>other special features and limits in the integration brief</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders include:</p> <ul style="list-style-type: none"> <li>clients</li> </ul>

	<ul style="list-style-type: none"> <li>• financier</li> <li>• project or operations team</li> <li>• support services, such as accounts and legal professionals, technical experts, suppliers and transporters</li> <li>• those responsible for plan implementation activities, such as installation, commissioning and process improvement</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Software and validation techniques</b>	<p>Software may be employed for performance analysis/modelling. Underpinning program techniques and algorithms should be understood, such as:</p> <ul style="list-style-type: none"> <li>• the use of failure effects analysis (FEA) and numerical methods within object oriented modelling techniques</li> </ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented design challenges which were completed using the software</li> </ul>
<b>Sustainability</b>	<p>For the purposes of this unit, sustainability includes consideration of economic, social, ecological and resources implications of activities. Sustainability issues may include:</p> <ul style="list-style-type: none"> <li>• resources and energy: <ul style="list-style-type: none"> <li>• sources, access, processing and consumption</li> <li>• food security and agriculture, health, education and shelter</li> <li>• land, energy and water</li> </ul> </li> <li>• social and economic factors affecting design of machines and equipment</li> <li>• life cycle design of product (manufacture to re-manufacture or recycle)</li> <li>• raw material, solids and hazardous waste, and production by-products</li> <li>• contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>• climate change</li> </ul>

<b>Monitor and support the implementation</b>	<p>Monitoring and supporting may include:</p> <ul style="list-style-type: none"> <li>• provision of assistance with hardware procurement and system assembly and arrangements to suit design</li> <li>• assisting installation and commissioning</li> <li>• provision of advice on adjustments, revisions and required documentation</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking:</p> <ul style="list-style-type: none"> <li>• is the process of developing solutions within the context of an entire system</li> <li>• recognises that an improvement in one subsystem can adversely affect another subsystem</li> </ul>
<b>Critical activities and resources</b>	<p>Critical activities and resources are those identified as critical to schedule milestones and project success</p>
<b>Standards and codes</b>	<p>Standards refer to all relevant Australian and international standards and codes applicable to a particular design task</p>
<b>Planning and scheduling techniques</b>	<p>Implementation requirements may be a critical factor in evaluation of design options. Planning and scheduling options may include:</p> <ul style="list-style-type: none"> <li>• critical path or Pert network plans and Gantt charts</li> </ul>

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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234003A Design machines and ancillary equipment

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of machines and ancillary equipment. It includes sustainability implications, occupational health and safety (OHS), modelling and calculations, use of software, product analysis and product life cycle design, investigating, generating ideas, synthesis, prototype completion and manufacture and evaluation.

## Application of the Unit

This unit applies to the design of any significant machinery and ancillary equipment for domestic, commercial, industrial, medical, military or entertainment purposes. Design activities may also include reverse engineering, design rectification or modifications of an existing design. Activities include the design of specific machine elements, such as shafts, bearings, brakes, clutches, springs, pressure vessels, flywheels, and may also include selection of ancillary equipment, such as motors, pumps and valves.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Clarify the design task and elaborate the specification | 1.1 Establish, in consultation with client, required features of machine and ancillary equipment   |
|   |   | 1.2 Determine parameters to the brief or contract  |
|   |   | 1.3 Determine stakeholders to be consulted in design process   |
|   |   | 1.4 Assess OHS, regulatory, sustainability or environmental issues relevant to design task   |
|   |   | 1.5 Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility   |
| 2 | Perform design analysis and prepare concept proposals   | 2.1 Carry out initial investigations and measurements  |
|   |   | 2.2 Using current industrial design techniques carry out required modelling and calculations using appropriate software                                    |
|   |   | 2.3 Generate a range of solutions to the design brief  |
|   |   | 2.4 Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements  |
|   |   | 2.5 Determine, social and sustainability implications of solutions   |
|   |   | 2.6 Review concept proposals with client and identify preferred solution   |
| 3 | Design machines or equipment                            | 3.1 Finalise selected machine or equipment design, including ensuring preparation of all required documentation, drawings, specifications and instructions |
|   |   | 3.2 Consult with client and stakeholders to obtain sign-off on design  |
|   |   | 3.3 Monitor installation and commissioning with stakeholders and make any necessary adjustments to design  |



## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required knowledge includes:

- determining features of machines or equipment, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in:
  - machine and equipment design
  - reverse engineering
  - sustainability issues and implications for machine and equipment design
  - materials
  - assembly, fabrication and construction techniques
  - lean and other quality techniques
  - latest relevant modelling and other software
- investigating and presenting options
- investigating faults in existing designs and proposing solutions
- selecting and using software and validation techniques, including 2-D and 3-D modelling
- creating design solutions to match client expectations of innovation as well as fitness for purpose
- designing for servicing, maintainability, cost, manufacturability and assembly, and ease of operation
- applying calculus to engineering design solutions requiring computations, such as rate of change, moments of inertia and friction forces
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- selecting materials, equipment and sub-assemblies based on availability, price and performance characteristics
- applying graphical techniques, such as those required by dynamic balancing diagrams
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement of proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering design methods

- research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- engineering design software options
- software validation processes
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements.
- machine element assembly arrangements and methods
- fastening and sealing methods
- gear design standards and techniques
- strength and stress analysis
- shaft design
- forces, stresses and deflections of coil springs
- stresses in thick-walled pressurised vessels and cylinders subject to shrink and press fitting
- disk, hydraulic and cone clutches
- velocity and acceleration analysis of mechanisms
- ergonomics principles
- materials selection
- failure modes

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine features of machines or equipment, OHS, regulatory and risk management requirements</li> <li>• generate design solutions</li> <li>• interpret parameters to the brief or contract</li> <li>• research current design trends and sustainability implications</li> <li>• investigate options for machine and equipment design</li> <li>• measure, model, calculate and analyse using software and validation techniques</li> <li>• innovate and create solutions</li> </ul>
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	<ul style="list-style-type: none"> <li>• evaluate solutions for feasibility against design criteria</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement of proposal and sign-off on design.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work

environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Range of solutions</b>	<p>Range of solutions may include those that:</p> <ul style="list-style-type: none"> <li>• satisfy the technical requirements of the design brief</li> <li>• are within budget</li> <li>• are able to be manufactured</li> <li>• meet any regulatory requirements</li> <li>• minimise environmental and sustainability impacts</li> </ul>
<b>Current industrial</b>	<p>Current industrial design techniques may relate to:</p>

<b>design techniques</b>	<ul style="list-style-type: none"><li>• sustainability and energy conservation</li><li>• life cycle design and recyclable components</li><li>• maintainability, manufacturability and reliability</li><li>• use of current codes and standards and risk minimisation</li><li>• developments in design techniques and design software along with software validation techniques</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234004A Design for engineering-related noise and vibration mitigation**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the design of noise and vibration mitigation systems for product, plant and equipment to ensure satisfactory operation, safety and comfort of people using, or in the proximity of the product, plant and equipment.

## **Application of the Unit**

This unit applies to the design of products, plant and equipment across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. The unit includes the selection and use of appropriate measuring and monitoring equipment, modelling and calculations, and incorporation of noise and vibration mitigation techniques into designs.

This unit does not cover structural or civil engineering-related noise mitigation techniques, such as the design of noise barriers and anechoic chambers.

Prior experience in application of scientific principles, mathematics, measurement and evaluation of noise and vibration, computer software and file handling is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Clarify the design brief and specifications for noise and vibration mitigation | 1.1 | Establish features of product, plant or equipment design specification likely to generate noise and vibration  |
|   |  | 1.2 | Confirm technical, commercial and environmental parameters to the brief or contract  |
|   |  | 1.3 | Determine stakeholders to be consulted in design process   |
|   |  | 1.4 | Assess occupational health and safety (OHS), regulatory, sustainability or environmental regulations and issues relevant to noise and vibration mitigation design task |
|   |  | 1.5 | Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility   |
| 2 | Evaluate design analysis and prepare concept proposals                         | 2.1 | Appraise initial qualitative and quantitative analysis of the design task using appropriate equipment and techniques   |
|   |  | 2.2 | Carry out required modelling and calculations using appropriate software and validation techniques   |
|   |  | 2.3 | Generate a range of noise and vibration mitigation solutions to the design brief   |
|   |  | 2.4 | Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements                  |
|   |  | 2.5 | Determine, social and sustainability implications of solutions   |
|   |  | 2.6 | Present concept proposals to client  |

- |   |   |     |   |
|---|---|-----|---|
| 3 | Design for noise and vibration mitigation | 3.1 | Evaluate concept proposals with client  |
|   |   | 3.2 | Ensure that design solution is optimised with respect to the noise and vibration mitigation design task   |
|   |   | 3.3 | Finalise noise and vibration mitigation design, including ensuring preparation of all required documentation, drawings, specifications and instructions |
|   |   | 3.4 | Consult with client and stakeholders to obtain sign-off on design   |
|   |   | 3.5 | Monitor installation and commissioning with stakeholders and make any necessary adjustments to design   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- designing noise and vibration mitigation solutions
- assessing features of plant and equipment designs that generate or decrease noise and vibration
- assessing a brief or contract specifications and the limits and constraints they impose on the ability to achieve noise and vibration mitigation in a design
- determining OHS, regulatory and risk management requirements
- selecting appropriate noise measurement and testing equipment and techniques
- selecting appropriate vibration measurement and testing techniques
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- investigating faults in existing designs and arriving at solutions



## Required knowledge

Required knowledge includes:

- common sources of noise and vibration in plant and equipment
- features of plant or equipment in relation to noise and vibration mitigation
- feasibility and evaluation methods and design criteria
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- noise and vibration modeling and calculation techniques
- current options and trends in performance analysis, modelling and simulation software, including underpinning program techniques, including software validation
- physiological effects of noise and vibration
- risk factors for vibration and the human body
- industrial health and safety – audiometric testing
- noise and vibration concepts, such as vibration, noise, transmission of noise and vibration, and harmonic excitation
- sources of noise generation in plant and equipment
- noise mitigation, such as hearing protection, insulation, enclosures, fans and ducts
- sources of vibrations in plant and equipment
- vibration mitigation and shock control measures
- options for noise reduction in machine design (rotor bearing positioning)
- statistical energy analysis (SEA)
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• design noise and vibration mitigation solution</li><li>• interpret features of plant and equipment and parameters to the brief or contract</li><li>• advise client based on discipline knowledge and OHS and regulatory standards</li></ul>
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	<ul style="list-style-type: none"> <li>• research sustainability implications and current industrial design techniques</li> <li>• determine OHS, regulatory and risk management requirements</li> <li>• select, calibrate and set up equipment</li> <li>• investigate and measure</li> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job, or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Initial qualitative and quantitative analysis</b>	<p>Initial qualitative and quantitative analysis may include:</p> <ul style="list-style-type: none"> <li>• a hazard and risk analysis related to existing or proposed plant or equipment</li> <li>• routine noise and vibration monitoring data or investigative measurements</li> </ul>

<b>Equipment and techniques</b>	Equipment and techniques may include: <ul style="list-style-type: none"><li>• data required related to test requirements</li><li>• spectrum analysis or simple noise measurement of linear sound pressure levels</li><li>• microphones and preamplifiers</li><li>• specialist applications requiring supplementary transducers to locate source of noise</li><li>• noise meters, such as hand-held, a-weighted, noise dose and precision options</li><li>• recording techniques and equipment for various environments and sound characteristics</li><li>• calibration</li><li>• electrodynamics exciter</li><li>• sinusoidal and random excitation</li><li>• sub and super harmonics</li><li>• force testing and structural response</li><li>• simulated and real environment testing of shock</li><li>• calibration</li></ul>
<b>Range of noise and vibration mitigation solutions</b>	Range of noise and vibration mitigation solutions may include: <ul style="list-style-type: none"><li>• controlling the source</li><li>• controlling the transmission path</li><li>• controlling the receiver</li><li>• changing the operating condition of plant and machinery</li><li>• vibration isolation</li><li>• active vibration control</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>Client</b>	Client may be: <ul style="list-style-type: none"><li>• internal or external to the designer's organisation</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234005A Design hydrodynamic pumping systems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of new or modified hydrodynamic pumping systems, including the layout; choice of motor and pumps, pipes and valves; the fluid source and delivery requirements of the system. It includes sustainability implications, occupational health and safety (OHS) and regulatory requirements.

## Application of the Unit

This unit applies to the design of hydrodynamic pumping systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. It applies to pumping system designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of scientific principles, evaluation of hydrodynamic systems, mathematics, computer software and file handling is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Clarify the design brief and elaborate the specification	1.1	Establish required features and performance parameters of hydrodynamic pumping system
		1.2	Confirm technical, commercial and environmental parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess OHS, regulatory, sustainability or environmental issues relevant to the design task
		1.5	Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2	Evaluate design analysis and prepare concept proposals	2.1	Appraise initial qualitative and quantitative analysis of the design task
		2.2	Carry out required detailed modelling and calculations using appropriate software and validation techniques
		2.3	Generate a range of solutions to the design brief, including choice of equipment, layout, fluid source and delivery
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements
		2.5	Determine, social and sustainability implications of solutions
		2.6	Present concept proposals to client
3	Design hydrodynamic pumping system	3.1	Evaluate concept proposals with client
		3.2	Ensure that design solution is optimised with respect to the system specifications

- 3.3 Finalise selected design, including equipment, layout, fluid source and delivery, and other features desired by client
- 3.4 Ensure preparation of all required documentation, drawings, specifications and instructions
- 3.5 Consult with client and stakeholders to obtain sign-off on design
- 3.6 Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- determining OHS, regulatory and risk management requirements
- investigating and measuring
- investigating faults in existing designs and arriving at solutions
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- designing hydrodynamic pumping systems solution using current design methods
- communicating, negotiating and reviewing with stakeholders and clients throughout the process
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- research and investigation methods
- techniques for:
  - continuous improvement

- problem solving and decision making
- root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- contemporary engineering design methods
- relevant engineering design software
- design, research, modelling and computational methodologies applied to hydrodynamic pumping systems
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- fundamentals of hydrodynamics, including properties of substances and conservation of energy principles
- types of pumps, such as centrifugal, rotary and reciprocating
- pumping systems specifications, such as head equations, performance curves, valves, flow rates and efficiency
- pump placements
- cavitations
- rotodynamic pump performance parameters and specifications
- series and parallel pumps
- practical pump installations and operation problems
- pumping special fluids, such as viscous fluids, slurries, Newtonian and non-Newtonian fluids

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret features of plant and equipment and parameters to the brief or contract</li> <li>• advise client based on discipline knowledge and OHS and regulatory standards</li> <li>• research sustainability implications and current industrial design techniques</li> <li>• determine OHS, regulatory and risk management requirements</li> <li>• investigate and measure</li> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> </ul>
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	<ul style="list-style-type: none"> <li>• design hydrodynamic pumping solution</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <p>These may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specification</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Range of solutions</b>	<p>Range of solutions may include those that:</p> <ul style="list-style-type: none"> <li>• satisfy the technical requirements of the design brief</li> <li>• are within budget</li> <li>• are able to be manufactured</li> <li>• meet any regulatory requirements</li> </ul>

	<ul style="list-style-type: none"><li>• minimise environmental and sustainability impacts</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>System specifications</b>	System specifications may include, but are not limited to: <ul style="list-style-type: none"><li>• pump types</li><li>• system head requirements</li><li>• pump performance requirements</li><li>• duty point</li><li>• flow rates</li><li>• cavitation issues and control</li><li>• power and efficiency</li><li>• energy cost of pumping</li><li>• valves for flow control</li><li>• component layout</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## **MEM234006A Evaluate and select thermodynamic systems or subsystems**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the evaluation of performance, efficiency and the selection of appropriate thermodynamic plant and equipment using thermodynamic principles, including the Law of Entropy and the Second Law of Thermodynamics, as applied to gas cycles and vapour cycles, flow-through nozzles and blade passages, impulse and reaction stages of turbines. It includes generation and transfer of heat energy using solid, liquid and gas mediums and application of software.

### **Application of the Unit**

This unit applies to the evaluation of performance, efficiency and selection of appropriate thermodynamic plant and equipment across all forms of manufacturing and engineering. It is suitable for Principal Technical Officers and people in equivalent positions working with heat transfer, air conditioning, solar, geo-thermal and other power generation applications involving thermal energy transfer.

Prior experience in the application of scientific principles, evaluation of thermodynamic system components, mathematics and computer techniques is required.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Clarify the specifications required for thermodynamic system	1.1	Establish features of plant and equipment and thermodynamic performance and efficiency parameters
		1.2	Confirm technical, commercial and environmental parameters to specifications
		1.3	Determine stakeholders to be consulted in evaluation and selection process
		1.4	Assess occupational health and safety (OHS), regulatory, sustainability or environmental regulations and issues relevant to the evaluation and selection task
		1.5	Confirm selection requirements, including budget and schedule, and provide preliminary advice on feasibility
2	Evaluate thermodynamic system options and prepare concept proposals	2.1	Appraise initial qualitative and quantitative analysis of the evaluation and efficiency task
		2.2	Carry out required modelling and calculations using appropriate software and validation techniques
		2.3	Generate a range of thermodynamic system solutions to the selection requirements, including choice of equipment, layout, fluid source and delivery
		2.4	Check feasibility and evaluate solutions against selection requirements ensuring conformity to standards and codes, technical, economic and OHS requirements
		2.5	Determine, social and sustainability implications of solutions
		2.6	Present concept proposals to client
3	Select	3.1	Evaluate concept proposals with client

thermodynamic system	3.2	Finalise selection, including equipment, layout, fluid source and delivery, and other features desired by client
	3.3	Ensure preparation of all required documentation, drawings, specifications and instructions
	3.4	Consult with client and stakeholders to obtain sign-off on selection
	3.5	Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- determining OHS, regulatory and risk management requirements
- modelling and calculating using appropriate software and validation techniques
- calculating, measuring and assessing thermodynamic system performance parameters, such as:
  - efficiency
  - fuel consumption
  - carbon equivalent emissions
- evaluating a range of solutions for feasibility against design criteria
- selecting thermodynamic systems to match performance and efficiency requirements
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on system selection
- document evaluation and selection with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- typical documentation, drawings, specifications and instructions required in thermodynamic

system selection processes

- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- current options and trends in design, performance analysis, and modelling and simulation software relevant to thermodynamic systems, including underpinning program techniques and software validation techniques
- concepts of thermodynamics, properties of substances, conservation of mass and energy principles
- Law of Entropy and the Second Law of Thermodynamics
- second law analysis of thermodynamic systems
- actual and ideal gas cycles and vapour cycles
- impulse and reaction stages of turbines
- theory of heat transfer, such as conduction, convection, and radiation through various materials and geometric shapes
- heat flow solutions by analytical, electrical analogy, graphical, numerical, failure effects analysis (FEA) and graphical software solution techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• interpret features of plant and equipment and parameters to the brief or contract</li><li>• advise client based on discipline knowledge and OHS and regulatory standards</li><li>• research sustainability implications and current thermodynamic system design techniques</li><li>• determine OHS, regulatory and risk management requirements</li><li>• model and calculate using appropriate software and validation techniques</li><li>• generate and evaluate a range of solutions for feasibility against selection requirements</li><li>• evaluate and select most appropriate thermodynamic solution</li><li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on selection</li><li>• document evaluation and selection with drawings, specifications and instructions.</li></ul>
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Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



<b>Parameters to the selection requirements</b>	<p>Parameters to the selection requirements include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• selection process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance and efficiency specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the requirements</li> </ul>
<b>OHS, regulatory requirements, codes of practice and enterprise procedures</b>	<p>OHS, regulatory requirements, codes of practice and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• codes of practice from Australian and overseas engineering and technical associations and societies</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Initial qualitative and quantitative analysis</b>	<p>Initial qualitative and quantitative analysis may include:</p> <ul style="list-style-type: none"> <li>• a hazard and risk analysis related to existing or proposed plant or equipment</li> <li>• routine noise and vibration monitoring data or investigative measurements</li> </ul>
<b>Appropriate software and validation techniques</b>	<p>Software may be employed for performance analysis/modelling. Underpinning program techniques and algorithms should be understood, such as:</p> <ul style="list-style-type: none"> <li>• the use of FEA and numerical methods within object oriented modelling techniques</li> </ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple thermodynamic system performance problems with software solutions to the same problems</li> <li>• review of previously implemented system performance challenges which were completed using the software</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular thermodynamic system task</p>

<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"><li>• meeting all regulatory requirements</li><li>• conforming to all industry covenants, protocols and best practice guides</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative OHS impact on employees, community and customer</li></ul>
<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"><li>• internal or external to the designer's organisation</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234007A Design fluid power systems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of fluid power systems, including pneumatic multi-actuator control systems; hydraulic systems, including hydrostatic transmissions, proportional and servo valve control, and programmable logic controllers (PLC). It includes occupational health and safety (OHS), regulatory requirements, automation safety and systematic design processes. Design considerations include dynamic loads and optimised control system response and stability.

## Application of the Unit

This unit applies to fluid power systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. It is suitable for fluid power system and automation designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in evaluation of fluid power systems and hydrodynamics, mathematics, computer techniques, basic electrical and controllers is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Interpret design brief for fluid power systems | 1.1 | Confirm the design brief and operational requirements with the client  |
|   |  | 1.2 | Establish technical, commercial and environmental parameters to the brief or contract  |
|   |  | 1.3 | Determine stakeholders to be consulted in design process   |
|   |  | 1.4 | Consider regulatory, sustainability or environmental issues relevant to the briefs   |
|   |  | 1.5 | Provide preliminary advice to client on the feasibility for realising the fluid power system design  |
| 2 | Prepare concept proposal                       | 2.1 | Analyse and establish worksite requirements for fluid power system realisation in conjunction with the client  |
|   |  | 2.2 | Undertake initial design investigations for fluid power system capacity and responsiveness   |
|   |  | 2.3 | Carry out required modelling, simulation and calculations using appropriate software, and test equipment to determine fluid power system, function, behaviour and safety |
|   |  | 2.4 | Generate a range of possible solutions to the design   |
|   |  | 2.5 | Check feasibility and validate solutions against design criteria ensuring conformity to OHS requirements and relevant standards  |
|   |  | 2.6 | Determine social and sustainability implications of solutions  |
|   |  | 2.7 | Review concept proposals with client to identify preferred solution  |

- |   |                           |     |  |
|---|---------------------------|-----|--|
| 3 | Design fluid power system | 3.1 | Develop selected fluid power design to meet specifications, including dimensioning, sizing and positioning of system components  |
|   |                           | 3.2 | Evaluate sequence and mode control methods for multi-actuator circuit, stand alone and network designs for implementation  |
|   |                           | 3.3 | Determine options for design of compressed air supply for a multi-application facility, if applicable  |
|   |                           | 3.4 | Ensure that design solution is optimised with respect to the system specifications   |
|   |                           | 3.5 | Develop fluid power design documentation, including drawings, circuit diagrams, specifications, operating instructions, manuals and training materials, if appropriate |
|   |                           | 3.6 | Check that the final design meets all required specifications and operational capabilities   |
|   |                           | 3.7 | Consult with client and stakeholders to obtain sign-off on design  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining features of fluid power systems, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching trends and techniques in:
  - fluid power design
  - reverse engineering
  - sustainability issues and implications
  - materials and components
  - assembly, fabrication and construction techniques
  - lean and other quality techniques
  - latest relevant modelling, simulation and validation techniques, and other software

- investigating and presenting options
- investigating faults in existing designs and propose solutions
- selecting and using software and validation techniques, including 2-D and 3-D modelling
- creating optimised design solutions for fluid power systems
- evaluating fluid power solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- communicating, negotiating and reviewing with stakeholders and clients throughout process to obtain agreement of proposal and sign-off on design
- documenting design with drawings, specifications and instructions

## **Required knowledge**

Required knowledge includes:

- fluid power design methods
- current options and trends in design, performance analysis, modelling and simulation software, including underpinning program techniques and software validation techniques
- research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- principles of fluid power designs
- dimensions, capacity and position of system components
- system responsiveness
- electrical and mechanical behaviours of fluid power systems
- hydraulics and designing with hydraulics components
- applications and characteristics of servo valves
- electronic controllers for proportional and servo valves
- sensor/transducer/amplifiers
- pneumatics and designing with pneumatic components
- multiple actuator control circuits
- compressed air system design
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements

## **Evidence Guide**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret features of plant and equipment and parameters to the brief or contract</li> <li>• advise client based on discipline knowledge and OHS and regulatory standards</li> <li>• research sustainability implications and current industrial design techniques</li> <li>• determine OHS, regulatory and risk management requirements</li> <li>• investigate options for fluid power design</li> <li>• measure, model, calculate, analyse and use software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• design optimum fluid power system solution</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, circuit diagrams, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its</li> </ul>

	<p>correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Parameters to the brief or contract</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• design cost and system capital cost</li> <li>• maintainability, product life cycle cost</li> <li>• durability, function, performance and aesthetics</li> <li>• energy and environmental sustainability and social issues</li> <li>• equipment availability and worksite restrictions</li> <li>• other special features and limits in the design brief</li> </ul>
<b>Sustainability</b>	<p>Sustainability may include:</p> <ul style="list-style-type: none"> <li>• resources and energy</li> <li>• social and economic</li> <li>• life cycle design of product raw material, solids and hazardous waste, and production by-products</li> <li>• contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>• climate change</li> </ul>
<b>Appropriate software</b>	Appropriate software may include software for:



	<ul style="list-style-type: none"> <li>• computer-aided design (CAD)</li> <li>• circuit design and analysis</li> <li>• animation</li> <li>• simulation</li> <li>• modelling</li> <li>• performance analysis</li> </ul>
<b>Validation techniques</b>	<p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented designs which were completed using the software</li> <li>• use of FMEA</li> </ul>
<b>Design criteria</b>	<p>Design criteria may include:</p> <ul style="list-style-type: none"> <li>• essential criteria, such as OHS and environmental criteria, which are pass/fail criteria for design option selection</li> <li>• desirable criteria, such as simplicity of design, which may be rated or scored to aid selection of design amongst options</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards</b>	<p>Standards may include:</p> <ul style="list-style-type: none"> <li>• AS 4024.1-2006 Series Safety of machinery</li> <li>• AS/NZS ISO 31000:2009 Risk management – Principles and guidelines</li> <li>• NOHSC:1010 National standard for plant</li> <li>• NOHSC:1014 National standard for the control of major hazard facilities</li> <li>• AS 61508.1-2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – General requirements</li> </ul>
<b>Sequence and mode control methods for multi-actuator circuit</b>	<p>Sequence may include:</p> <ul style="list-style-type: none"> <li>• sequential operations with or without conditional jumps</li> </ul>

	<ul style="list-style-type: none"> <li>• optimisation techniques</li> <li>• functions, such as: <ul style="list-style-type: none"> <li>• timing, counting, stop start, cycle selection and boundary conditions</li> </ul> </li> </ul> <p>Control methods may include:</p> <ul style="list-style-type: none"> <li>• pneumatic and electrical relay cascade control</li> <li>• pneumatic and electrical relay step-sequenced control</li> <li>• PLC control</li> <li>• microcontrollers for special purpose machines</li> </ul>
<b>Stand alone and network control</b>	<p>Options for stand alone and network control of fluid power systems may include:</p> <ul style="list-style-type: none"> <li>• compressor control and application control</li> <li>• fluid powered machine control, including proportional-integral-derivative (PID) parameter control from remote host controller</li> <li>• communications bus systems and serial systems</li> <li>• distributed control systems (DCS)</li> <li>• system control and data acquisition (SCADA)</li> <li>• computer-integrated manufacture (CIM) options</li> </ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234008A Design plant using computer simulations

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the use of computer simulations to develop engineering solutions for the design of plant, equipment and manufacturing processes. It includes mathematical models and computer simulation models, sensitivity estimation and optimisation to ensure reliability, validity and robustness of simulations.

## Application of the Unit

This unit applies to the use of computer simulation for design of significant plant, equipment or manufacturing processes across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. It is suitable for plant and process designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the evaluation of plant and processes; scientific principles; analysis of loads on machine elements; selection of components; mathematics, including calculus and differential equations, materials, manufacturing processes and computer-aided design (CAD) is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised
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unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Clarify the simulation task and elaborate the specification	1.1	Establish, in consultation with client, required features of the computer simulations
		1.2	Determine parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess occupational health and safety (OHS), regulatory, sustainability or environmental issues relevant to design task
		1.5	Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2	Research and test computer simulation options for a range of applications	2.1	Analyse computer simulations software for reliability, validity and robustness
		2.2	Assess process simulation software for applications in commercial plant and processes
		2.3	Test computer simulation software with known solutions
		2.4	Select the most appropriate simulation option for the application
3	Prepare concept proposal	3.1	computer simulation design
		3.2	Complete required modelling, optimisation and sensitivity analysis
		3.3	Generate a range of design solutions, if required
		3.4	Check feasibility and evaluate solutions against design criteria, standards and codes ensuring conformity to OHS requirements

- |   |  |     |  |
|---|--|-----|--|
|   |  | 3.5 | Prepare a proposal that includes results of feasibility study, consideration of expert opinion, initial calculations, modelling and the use of judgment and discretion |
|   |  | 3.6 | Review concept proposal with client to improve outcomes and overcome possible problems   |
|   |  | 3.7 | Negotiate adjustments to brief or contract parameters if required  |
| 4 | Design plant, equipment or manufacturing process | 4.1 | Design plant, equipment or process using chosen simulation methods   |
|   |  | 4.2 | Optimise simulation and analyse sensitivity  |
|   |  | 4.3 | Provide documentation, graphics, specifications and instructions   |
|   |  | 4.4 | Consult with client and stakeholders   |
|   |  | 4.5 | Obtain sign-off on design simulation   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining design parameters, performance targets and system variables of plant, equipment or process to be simulated, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in:
  - computer simulation models, methods for sensitivity estimation and optimisation to ensure reliability, validity and robustness of simulation, simulation software, and programming and validation techniques
  - reverse engineering
  - sustainability implications and implications for computer simulation design applications
  - selecting appropriate simulation model

- modelling, optimising and analysing model sensitivity
- generating and evaluating a range of solutions using appropriate innovation and creativity for feasibility against design criteria
- investigating faults in existing designs and arriving at solutions
- designing simulated plant
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on simulated design
- documenting design with files, drawings, specifications and instructions

## Required knowledge

Required knowledge includes:

- design methods, research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- computer simulation packages
- advantages of design simulation, such as development time, low cost and minimum resources
- disadvantages of design simulations, such as level of uncertainty, and cost of making decisions based on invalid simulations
- simulation applications:
  - physical simulation using physical objects as analogues of another reality
  - interactive simulation or 'human in the loop' simulations (e.g. space experiences, flight and driving simulation, medical procedure training etc.)
  - computer architecture simulation
  - training simulation
  - business performance
  - plant or process design
- mathematical models:
  - linear and non-linear
  - deterministic and stochastic
  - steady-state and dynamic
  - lumped and distributed parameter models
- computer simulation types:
  - continuous and discrete
  - deterministic and stochastic
  - local or distributed simulations

- object-oriented physical modelling (OOPM) simulation
- model variable types:
  - state variables, constants and random variables
  - inputs, outputs and decisions variables
- sensitivity estimation and optimisation
- graphical techniques for visual model building

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret design parameters, performance targets and system variables of plant, equipment or process to be simulated</li> <li>• advise client based on discipline knowledge, OHS and regulatory standards</li> <li>• research sustainability implications, computer simulation design applications, mathematical and computer simulation models, methods for sensitivity estimation and optimisation to ensure reliability, validity and robustness of simulation, simulation software, programming and validation techniques</li> <li>• determine OHS, regulatory and risk management requirements related to plant</li> <li>• investigate and measure to confirm the parameters for required design</li> <li>• select appropriate simulation model</li> <li>• model, optimise and analyse model sensitivity</li> <li>• generate and evaluate a range of solutions using appropriate innovation and creativity for feasibility against design criteria</li> <li>• design simulated plant</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on simulated design</li> <li>• document design with files, drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace</li> </ul>

	<p>situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Computer simulations</b>	<p>A computer simulation is a computer programme or network of computers that attempts to simulate an abstract model of a</p>



	<p>particular system in order to gain insight into the operation of the system or operator characteristics</p> <p>Typical applications include:</p> <ul style="list-style-type: none"> <li>• process simulations</li> <li>• performance analysis and optimisation</li> <li>• fault simulations</li> <li>• machine simulations, stress, deflection and heating</li> <li>• environmental modelling</li> <li>• mathematical design modelling</li> <li>• hydraulic system modelling</li> <li>• virtual engineering</li> </ul>
<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> </ul>

	<ul style="list-style-type: none"> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>Sensitivity estimation, optimisation and validation</b>	<ul style="list-style-type: none"> <li>• Software may be employed for estimation, optimisation and validation.</li> <li>• Sensitivity is a measure of impacts of changes to parameter values and assumptions on the output or conclusions from the model. Sensitivity analysis can be used as a measure of robustness and validity.</li> <li>• Optimisation is the process of adjustment of variables and parameters to fine-tune the output to closer match expected real system outputs.</li> <li>• Validation techniques include: <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented design challenges which were completed using the software</li> <li>• robustness relates to the ability of a simulation model to respond to inputs in a stable manner</li> </ul> </li> </ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234009A Design computer-integrated manufacturing systems**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the design of a computer-integrated manufacturing (CIM) system, including control of machine and processes and the generation of manufacturing information. It includes occupational health and safety (OHS), automation safety and risk management.

## **Application of the Unit**

This unit applies to the design of automated plant and equipment, control and data sharing systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for automated manufacturing system designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of computing technology, mathematics, scientific principles and techniques, electrical principles and techniques, programming of computers and controllers, methods, processes and mechanical construction techniques, manufacturing plant and processes, and evaluation of CIM systems is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Interpret the design brief or contract requirements for CIM system | 1.1 Establish, in consultation with the client, the required features and extent of integration of the CIM system<br><br>1.2 Establish technical, commercial and environmental parameters to the brief or contract<br><br>1.3 Determine stakeholders to be consulted in design process<br><br>1.4 Consider <b>OHS, regulatory requirements and enterprise procedures relevant to the brief</b><br><br>1.5 Provide preliminary advice to the client on feasibility of the CIM project  |
| 2 | Prepare concept proposal   | 2.1 Carry out initial investigations and measurements<br><br>2.2 Carry out required modelling and calculations using appropriate software and validation techniques<br><br>2.3 Generate a range of solutions that include consideration of data requirements, hardware requirements, system integration, network topology, communication protocols and automation safety, using appropriate innovation and creativity<br><br>2.4 Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements<br><br>2.5 Determine social and sustainability implications of solutions<br><br>2.6 Review concept proposals with client and identify preferred solution |

3	Design CIM system	3.1	Develop CIM design that includes results of feasibility study, consideration of expert opinion, initial calculations and modelling and the use of judgment and discretion
		3.2	Provide documentation, drawings, specifications and instructions
		3.3	Consult with client and stakeholders
		3.4	Obtain sign-off on design

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining features of CIM system, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in CIM practices, including:
  - machine and equipment design
  - reverse engineering
  - sustainability issues and implications for machine and equipment design
  - assembly, fabrication and construction techniques
  - purchasing and inventory control systems
  - lean and other quality techniques
  - latest relevant modelling and other software
- investigating and presenting options
- investigating faults in existing designs and arriving at solutions
- selecting and using software and validation techniques
- creating design solutions to match client expectations of innovation as well as fitness for purpose
- designing for servicing, maintainability, cost, manufacturability and assembly, and ease of operation
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design

- documenting design with drawings, specifications and instructions

## Required knowledge

Required knowledge includes:

- current CIM design knowledge, skills and techniques, including mechanical, electrical, fluid, electronic and information technologies, sensor/transducers, controllers, interfacing and signal conditioning, networking, software, data sharing and control functions
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- features and capability of plant, equipment, controllers, software, network and communication systems
- OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- engineering design software options
- contemporary engineering design methods
- software options for control and data sharing
- hardware options and capabilities to suit processes and products
- programming and use of CIM software
- documentation, drawings, specifications, instructions required, process information and programming

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• interpret features of plant and equipment and parameters to the brief or contract</li><li>• advise client based on discipline knowledge and OHS and regulatory standards</li><li>• research sustainability implications and current industrial design techniques</li><li>• determine OHS, regulatory and risk management requirements</li><li>• investigate and measure</li></ul>
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	<ul style="list-style-type: none"> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• design CIM system solution</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, a combination of both on and off the job, or off the job if suitable design and simulation facilities to test the design are available. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Parameters of the brief or contract</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• design cost and system capital cost</li> <li>• maintainability and product life cycle cost</li> <li>• durability, function, performance and aesthetics</li> <li>• energy and environmental sustainability and social issues</li> <li>• equipment availability and worksite restrictions</li> <li>• other special features and limits in the design brief</li> </ul>
<b>CIM</b>	<p>CIM is a method of manufacturing in which the production process is controlled by computer. It may include:</p> <ul style="list-style-type: none"> <li>• computer-aided design/computer-aided manufacturing (CAD/CAM)</li> <li>• computer-aided process planning (CAPP)</li> <li>• computer numerical control (CNC) machine tools</li> <li>• direct numerical control (DNC) machine tools</li> <li>• flexible machining systems (FMS)</li> <li>• automated storage and retrieval systems (ASRS)</li> <li>• automated guided vehicles (AGV)</li> <li>• use of robotics and automated conveyance</li> <li>• computerised scheduling</li> <li>• production and inventory control</li> <li>• a business system integrated by a common database</li> </ul>
<b>Range of solutions</b>	<p>Range of solutions for CIM systems may include:</p> <ul style="list-style-type: none"> <li>• hardware options, such as: <ul style="list-style-type: none"> <li>• processing machinery</li> <li>• transfer devices, robots, conveyors, and other automated pick and place devices</li> <li>• materials handling equipment</li> <li>• AGVs</li> <li>• programmable logic controllers (PLCs)</li> <li>• remote terminal units (RTUs)</li> <li>• human, machine interfaces (HMIs), e.g. touch screens</li> <li>• wired and wireless networking systems</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>• software options and systems, such as:             <ul style="list-style-type: none"> <li>• CAD/CAM</li> <li>• CAPP</li> <li>• system control and data acquisition (SCADA)</li> <li>• distributed control systems (DCS)</li> <li>• ASRS</li> <li>• enterprise resource planning (ERP)</li> <li>• quality assurance (QA) and quality control (QC) systems</li> <li>• local area network (LAN) and wide area network (WAN) network communications</li> </ul> </li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>Appropriate software and validation techniques</b>	<p>Software may be employed for:</p> <ul style="list-style-type: none"> <li>• performance analysis/modelling. Underpinning program techniques and algorithms should be understood, such as the use of FEA and numerical methods within object oriented modelling techniques</li> </ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented design challenges which were completed using the software</li> </ul>
<b>Network topology</b>	<p>Network topology refers to the arrangement of connected hardware. These include:</p> <ul style="list-style-type: none"> <li>• bus, ring, star, tree, mesh and in-line (2 way comms.)</li> </ul>

	<p>arrangements</p> <ul style="list-style-type: none"> <li>wired and wireless options</li> </ul>
<b>Communications protocols</b>	<p>Communications protocols refer to the set of standardised rules for data and signal syntax, checking and error detection. Hardware and software generate data in accordance with a protocol that allows generators and receivers to understand or translate the data as information, control signals integrity and error checks. These include:</p> <ul style="list-style-type: none"> <li>layered communications and networking protocols</li> <li>OSI Model – Open Systems Interconnection Model – 7 layers</li> <li>TCP/IP Internet Protocol Suite {Transmission Control Protocol (TCP) and the Internet Protocol (IP)} – 4 or 5 layers</li> <li>IEEE 802 LAN/MAN group of standards, including IEEE 802.3 Ethernet standard, IEEE 802.11 Wireless Networking standard</li> <li>interface standards, such as RS232 and RS485, Fieldbus, Modbus and DNP3.0</li> </ul>
<b>Automation safety</b>	<p>Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems.</p>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234010A Design microcontroller applications**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the design of an automated device for a machine or equipment using a microcontroller. The automated device may use digital or analog input/output (I/O) and may involve feedback control. The microcontroller application may be an autonomous device or it may be integrated into a local area network (LAN) or distributed control system (DCS) using wired or wireless communications. It includes sustainability implications, occupational health and safety (OHS) and automation safety.

## **Application of the Unit**

This unit applies to the design of automated devices using microcontrollers across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. The unit is suitable for automated device or systems designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of basic computing, controllers, mathematics, electrical, electronic, and evaluation of microprocessor systems and safety procedures is required. Mechanical, fluid power, thermodynamic, manufacturing methods and processes experience may be required by particular system designs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Clarify client brief or contract requirements | 1.1 Establish, in consultation with the client, the required features and functions of the microcontroller application<br><br>1.2 Determine technical, commercial and environmental parameters to the brief or contract<br><br>1.3 Determine stakeholders to be consulted in design process<br><br>1.4 Provide initial advice to client on the feasibility of the project  |
| 2 | Prepare concept proposal                      | 2.1 Carry out initial investigations and measurements<br><br>2.2 Carry out required modelling and calculations<br><br>2.3 Where appropriate, consider need for continuous improvement, constraints and contingency management, as part of concept proposal<br><br>2.4 Generate a range of microcontroller application design options<br><br>2.5 Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements<br><br>2.6 Prepare a device design proposal that includes appropriate consideration of results of feasibility study, required modelling and calculations, and any required expert opinions<br><br>2.7 Review concept proposal with client and select preferred solution |

3	Design microcontrolled device	3.1	Finalise selected device design
		3.2	Provide documentation, drawings, specifications and instructions
		3.3	Consult with client and stakeholders to obtain sign-off on design
		3.4	Monitor installation and commissioning with stakeholders, when required, and make any necessary modifications

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of microcontrollers
- researching latest trends and techniques in reverse engineering
- investigating, measuring, modelling and calculating for options
- investigating faults in existing designs and arriving at solutions
- prototyping and systematically programming and testing actuators and interfaces, input sensor/transducers, communications and network connections, human machine interfaces (HMIs) and graphical user interfaces (GUIs)
- generating and evaluating a range of solutions for feasibility against design criteria
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- selecting actuators, interfaces, microcontroller, sensor/transducers, signal conditioning, HMIs, communication and network software and connections, if required
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering microcontroller application design methods
- research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- engineering design software options
- software simulation/validation processes
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- microcontroller software programming techniques
- control options
- device component options which may include microcontroller, user interfaces, HMIs and GUIs, software, data communications, telemetry, modems and networking topology, as appropriate
- specifications for I/O and I/O channels

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret features and functions of the application and parameters to the brief or contract</li> <li>• determine sustainability, automation safety, OHS, regulatory and risk management</li> <li>• research and test system components</li> <li>• investigate and measure, model and calculate for options</li> <li>• generate and evaluate a range of solutions</li> <li>• design microcontrolled system solution</li> <li>• consider continuous improvement, constraint and contingency management requirements in design options, where this is appropriate to the application</li> <li>• select system components</li> <li>• prototype and systematically program and test system component</li> </ul>
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	<p>function</p> <ul style="list-style-type: none"> <li>• ensure automation safety using appropriate licensed technical and professional assistance</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of microcontrollers
- researching latest trends and techniques in reverse engineering
- investigating, measuring, modelling and calculating for options
- investigating faults in existing designs and arriving at solutions
- prototyping and systematically programming and testing actuators and interfaces, input sensor/transducers, communications and network connections, human machine interfaces (HMIs) and graphical user interfaces (GUIs)
- generating and evaluating a range of solutions for feasibility against design criteria
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- selecting actuators, interfaces, microcontroller, sensor/transducers, signal conditioning, HMIs, communication and network software and connections, if required
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering microcontroller application design methods
- research and investigations methods
- techniques for:
- continuous improvement
- problem solving and decision making
- root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- engineering design software options
- software simulation/validation processes
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- microcontroller software programming techniques
- control options



- device component options which may include microcontroller, user interfaces, HMIs and GUIs, software, data communications, telemetry, modems and networking topology, as appropriate
- specifications for I/O and I/O channels

## **Unit Sector(s)**

Engineering practice

## **Custom Content Section**

Not applicable.

# **MEM234011A Design programmable logic controller applications**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the design of an engineering application using a programmable logic controller (PLC). It includes sustainability implications, occupational health and safety (OHS) and automation safety.

## **Application of the Unit**

This unit applies to the control of machines, equipment or processes that may have thermodynamic, hydrodynamic, fluid power or mechanical system elements using a PLC. Control functions may be digital and analog and may include feedback. Network and remote control may be used. The unit is suitable for mechatronics and automated systems designers, systems maintenance, machine and process control, or computer-integrated manufacturing (CIM) designers. Design activities may also include reverse engineering, and design rectification or modifications of an existing design.

Prior experience in the evaluation of PLC systems, application of computing, controllers, mathematics, and basic electrical and electronics safety procedures is required. Additionally, experience in mechanical, fluid power, thermodynamic, manufacturing methods and processes may be required by particular system designs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills..

## **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Clarify client brief or contract requirements | 1.1 Establish, in consultation with the client, the required features and functions of the application and establish control requirements<br><br>1.2 Determine technical, commercial and environmental parameters to the brief or contract<br><br>1.3 Determine stakeholders to be consulted in the design and application process<br><br>1.4 Provide initial advice to client on the feasibility of the project   |
| 2 | Prepare concept proposal                      | 2.1 Carry out initial investigations and measurements<br><br>2.2 Carry out required modelling or simulations and calculations, using appropriate software and validation techniques<br><br>2.3 Generate a range of PLC application solutions<br><br>2.4 Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements<br><br>2.5 Prepare a PLC proposal that may include results of feasibility study, consideration of expert opinion, initial calculations and modelling, and the use of judgment and discretion<br><br>2.6 Review concept proposal with client and select preferred solution |
| 3 | Design PLC control application                | 3.1 Finalise selected control application design<br><br>3.2 Provide documentation, drawings, specifications and,   |

instructions

- 3.3 Consult with client and stakeholders to obtain sign-off on design
- 3.4 Monitor installation and commissioning with stakeholders, when required, and make any necessary modifications

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the PLC application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of PLCs, PLC functions and programming options
- researching latest trends and techniques in reverse engineering
- investigating and measuring, modelling and calculating for options
- investigating faults in existing designs and arriving at solutions
- prototyping and systematically programming and testing actuators and interfaces, input sensor/transducers, communications and network connections, human machine interfaces (HMIs) and graphical user interfaces (GUIs)
- generating a range of solutions and evaluating them for feasibility against design criteria, engineering practice and financial analysis
- selecting actuators, interfaces, microcontroller, sensor/transducers, signal conditioning, HMIs, communication and network software and connections, if required
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering PLC application design methods
- automation fundamentals, including mechanical, electrical, electronic and information technologies, sensor/transducers, controllers, interfacing and signal conditioning, networking

- (if required), software, data sharing and control functions
- features and capability of plant, equipment, controllers, software, network and communication systems
  - OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
  - processes for investigation, developing options, modelling and calculating, generating a range of solutions, completing feasibility and evaluation studies, and preparing proposals
  - use of techniques for:
    - continuous improvement
    - problem solving and decision making
    - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
  - communications and control systems standards, protocols and programming
  - system logic as flow charts and state diagrams
  - specifications for inputs/outputs (I/O)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret features and functions of the application and parameters to the brief or contract</li> <li>• determine sustainability, automation safety, OHS, regulatory and risk management</li> <li>• research and test system components</li> <li>• investigate and measure, model and calculate for options</li> <li>• generate and evaluate a range of solutions</li> <li>• design PLC system solution</li> <li>• implement systems thinking, continuous improvement and constraint and contingency management</li> <li>• select system components</li> <li>• prototype and systematically program and test system component function</li> <li>• ensure automation safety, using appropriate licensed technical and professional assistance</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> </ul>
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	<ul style="list-style-type: none"> <li>document design with drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Parameters to the brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>PLC solutions</b>	<p>PLC solutions may include consideration of:</p> <ul style="list-style-type: none"> <li>• I/O capacity</li> <li>• I/O module types: <ul style="list-style-type: none"> <li>• discrete</li> <li>• special</li> </ul> </li> <li>• signal conditioning</li> <li>• interface requirements</li> <li>• control functions</li> <li>• system integration</li> <li>• communication protocols</li> <li>• automation safety</li> <li>• network topology</li> <li>• programming languages</li> </ul>
<b>Applications</b>	<p>Applications may include:</p> <ul style="list-style-type: none"> <li>• control of machines, equipment or processes that may have thermodynamic, hydrodynamic, fluid power or mechanical system elements</li> <li>• control functions: <ul style="list-style-type: none"> <li>• digital</li> <li>• analog</li> <li>• feedback loops</li> </ul> </li> <li>• communications networks and remote control</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> </ul>

	<ul style="list-style-type: none"><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative OHS impact on employees, community and customer</li><li>• state and territory regulatory requirements</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.



# **MEM234012A Design integrated maintenance management systems**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills required for the systematic design of integrated maintenance processes to complement engineering and business objectives through the maximisation of plant utilisation. It includes consideration of quality aspects, design for reliability and maintainability, and the generation of system data which is analysed and used to aid continuous improvement processes.

## **Application of the Unit**

This unit applies to the design of integrated maintenance systems for existing plant and for new plant and processes in all areas of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for maintenance personnel and system designers involved in engineering, manufacturing and related asset maintenance systems, and those pursuing engineering or related qualifications and careers.

Prior or concurrent experience in evaluation of maintenance systems, mathematics, mechanical, electrical, fluid, thermal, production methods and processes, materials handling and automated systems, repair techniques, occupational health and safety (OHS) and risk management is required.

This unit applies where substantial engineering-related skills are required to design the maintenance management system.

Where the emphasis is on competitive manufacturing related skills, such as lean manufacturing, reliability centred maintenance (RCM), proactive or total productive maintenance (TPM), and the engineering support is provided by other personnel, then the unit MSACMT681A Develop a proactive maintenance strategy should be considered.

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret client brief or contract requirements	1.1	Determine required features of the integrated maintenance management system
		1.2	Interpret parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Research current maintenance systems and management techniques relevant to brief or contract, including lean systems maintenance, systems thinking, continuous improvement, and constraint and contingency management
		1.5	Assess OHS regulatory, sustainability or environmental issues relevant to contract or brief
		1.6	Seek appropriate technical and professional assistance as required
		1.7	Provide initial advice on feasibility based on specified or anticipated operations, including expectations for equipment availability and budget for maintenance
2	Prepare concept	2.1	Establish integrated maintenance management system

proposal	options for plant and plant support services
	2.2 Establish facilities and service maintenance response system options
	2.3 Categorise maintainable assets
	2.4 Establish data collection, storage, analysis and system feedback requirements
	2.5 Establish personnel participation and development requirements.
	2.6 Carry out required modelling and calculations using appropriate software and validation techniques
	2.7 Generate a range of solutions to the design brief ensuring conformity with OHS requirements
	2.8 Determine social and sustainability implications of solutions
	2.9 Review concept proposals with client to identify most appropriate solution
3 Design and handover integrated maintenance management system	3.1 Develop integrated maintenance management system design
	3.2 Provide documentation, diagrams, specifications and instructions
	3.3 Consult with client and stakeholders on features and operation of final design
	3.4 Obtain sign-off on design
	3.5 Monitor implementation with stakeholders and make any necessary adjustments to design

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- designing maintenance system proposals that are properly integrated with engineering and business objectives
- categorising maintainable assets
- determining maintainable features of plant and equipment and parameters to the brief or contract
- determining OHS, regulatory, risk management and sustainability requirements
- advising clients based on discipline knowledge and OHS and regulatory standards
- establishing maintenance management system options for plant and plant support services, facilities and service maintenance response system options, data collection, storage, analysis and system feedback requirements, and personnel participation and development requirements
- investigating faults in existing designs and proposing solutions
- analysing financial costs and management implications of maintenance management systems, including life cycle cost and break-even
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- planning for staffing requirements and training to operate maintenance management system
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

## Required knowledge

Required knowledge includes:

- current maintenance management techniques and systems
- options and trends in performance analysis, modelling and simulation software
- design techniques for reliability, maintainability and life cycle costing
- maintenance system options, such as corrective, preventative, predictive (condition monitoring), precision, RCM, proactive or TPM
- economic, social and environmental implications of maintenance management systems
- OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- technical and professional support services required to comply with license, legal and indemnity requirements
- processes for investigation, such as developing options, modelling and calculating, generating a range of solutions, completing feasibility and evaluation studies and preparing proposals
- maintainable features of assets
- asset importance, such as risk to operations, critical plant, semi-critical and remainder of plant
- strategies for critical assets to maintain reliability, such as back-up assets, storing spares and

- use of redundant monitoring
- maintenance activities, online and break-down, such as manual and instrumented monitoring, adjustments, lubrications, lubricant testing, alignments, balancing, machining, fabricating, assembling and mounting, and reporting results
- management of spares inventory recognising cost and criticality of assets
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
  - theory of constraints (TOC)
- integrated maintenance data systems, including analysis, collection, handling, storage, scheduling, recording and reporting
- maintenance and operational system control documents, such as flowcharts, schedule and report templates, network specifications, data analysis and feedback procedures
- monitoring options, such as manual and sensor/transducer options

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• design a maintenance system proposal integrated with engineering and business objectives</li> <li>• interpret maintainable features of plant and equipment and parameters to the brief or contract</li> <li>• advise client on maintenance system options</li> <li>• research current maintenance management techniques and systems</li> <li>• establish maintenance management system options</li> <li>• categorise maintainable assets</li> <li>• determine sustainability and OHS, regulatory and risk management requirements</li> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• communicate, negotiate and review with stakeholders and client</li> </ul>
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	<p>throughout process to obtain agreement on proposal and sign-off on design</p> <ul style="list-style-type: none"> <li>document design with drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>Full assessment of this unit would normally need to be undertaken on the job in the context of a commercial design project and software. Assessment of some elements of the maintenance system design process may be possible off the job providing full plant simulation facilities and software are available that reflect realistic workplace situations.</li> <li>The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the

candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Integrated maintenance management systems</b>	<p>Integrated maintenance management systems usually combine management, financial, engineering and other practices for cost-effective maintenance of assets such as plant, equipment and facilities. These systems involve the design for reliability and maintainability, manufacture, installation, commissioning and eventual write-off and replacement of the assets. Data is collected and analysed to assess the reliability, life cycle costs and productivity of the assets against the design criteria.</p> <p>Reliability relates to the productivity of assets, that is, the maintenance of service or product output (quantities) and its quality within cost parameters. Systems may also include consideration of:</p> <ul style="list-style-type: none"> <li>• maintenance priority</li> <li>• maintenance activity audit</li> <li>• monitoring and testing</li> <li>• maintenance system data</li> <li>• facilities and service maintenance response systems</li> <li>• maintainability</li> </ul>
<b>Parameters to the brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>Maintenance systems</b>	<p>Maintenance systems may include:</p> <ul style="list-style-type: none"> <li>• break-down maintenance</li> <li>• preventive maintenance</li> <li>• predictive maintenance (On-condition)</li> </ul>

	<ul style="list-style-type: none"> <li>• precision maintenance</li> <li>• proactive maintenance</li> <li>• reliability centred maintenance</li> <li>• total productive maintenance</li> </ul>
<b>Lean systems maintenance</b>	<p>Lean maintenance systems aim at maximising machine and process uptime, minimising waste and costs, maintaining quality and delivery and customer service. Maintenance processes and procedures are subject to continuous improvement and are set to complement engineering business objectives. Processes covered under the lean systems maintenance reference include:</p> <ul style="list-style-type: none"> <li>• process improvement</li> <li>• problem solving and decision making</li> <li>• RCA, FMEA or DRBFM</li> <li>• application of TOC</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking:</p> <ul style="list-style-type: none"> <li>• is the process of developing solutions within the context of an entire system</li> <li>• recognises that an improvement in one subsystem can adversely affect another subsystem</li> </ul>
<b>Continuous improvement</b>	<p>Continuous improvement implementation may relate to:</p> <ul style="list-style-type: none"> <li>• plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance</li> </ul>
<b>Constraints and contingencies</b>	<p>Contingencies are unplanned events that may require a maintenance system response. Examples may include:</p> <ul style="list-style-type: none"> <li>• breakdowns</li> <li>• loss of services</li> <li>• sudden increases or decreases in production</li> <li>• regulatory change</li> </ul> <p>Constraints are limitations on possible maintenance system solutions. These may be technical or physical constraints, such as:</p> <ul style="list-style-type: none"> <li>• lack of spare parts</li> <li>• delays in supply</li> </ul>



	<ul style="list-style-type: none"> <li>• shortage of skilled workers</li> <li>• limits to site access or logistical limitations</li> <li>• financial, regulatory or internal procedures constraints</li> </ul>
<b>OHS, regulatory requirements and enterprise procedures</b>	<p>OHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have intrinsic dangers, for example: <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring with high current control voltages above extra low voltage</li> </ul> </li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> </ul>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>• meeting all regulatory requirements</li> <li>• conforming to all industry covenants, protocols and best practice guides</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the</li> </ul>

	<p>community</p> <ul style="list-style-type: none"> <li>• minimising the negative OHS impact on employees, community and customer</li> </ul>
<b>Data collection, storage and analysis</b>	<p>Manual methods or maintenance management software may be employed for:</p> <ul style="list-style-type: none"> <li>• management of asset data, maintenance inventory, maintaining essential documentation (e.g. material safety data sheets (MSDS), work permits and databases)</li> <li>• planning, data recording and analysis</li> <li>• generation of documents, such as work orders, inventory reorders, and reports for process improvement or design feedback</li> </ul> <p>Software options include:</p> <ul style="list-style-type: none"> <li>• computer maintenance management (CMM)</li> <li>• computer-aided process planning (CAPP)</li> <li>• system control and data acquisition (SCADA)/distributed control systems (DCS)</li> <li>• automated storage and retrieval systems (ASRS)</li> <li>• enterprise resource planning (ERP)</li> <li>• quality assurance (QA) and quality control (QC) systems software</li> </ul>
<b>Personnel participation and development requirements</b>	<p>Personnel, participation and development requirements in the maintenance system include the determination of labour requirements and functions for:</p> <ul style="list-style-type: none"> <li>• autonomous and supervised maintenance-related activities, such as monitoring, adjustment, lubrication, disassembly, repair or replacement of parts, balancing and assembly</li> <li>• installation, alignment and recommissioning in accordance with standard procedures</li> <li>• participation in process improvement, including: <ul style="list-style-type: none"> <li>• measuring performance against benchmarks, such as life cycle costs, time between failures (TBF), and overall equipment effectiveness (OEE), as appropriate to individual job functions in design or operations</li> </ul> </li> <li>• data management, generation, recording,</li> </ul>

	<p>analysing, storing and use of software</p> <ul style="list-style-type: none"><li>• required training, including:<ul style="list-style-type: none"><li>• training for systems participation</li><li>• technical training</li></ul></li></ul>
<b>Appropriate software and validation techniques</b>	<p>Software may be employed for:</p> <ul style="list-style-type: none"><li>• performance analysis/modelling. Underpinning program techniques and algorithms should be understood, such as the use of FEA and numerical methods within object oriented modelling techniques</li></ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"><li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li><li>• review of previously implemented design challenges which were completed using the software</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234013A Plan and design engineering-related manufacturing processes**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to plan and design engineering-related manufacturing processes, including consideration of client requirements, process control, sustainability, lean systems, product manufacturability, system maintainability, facilities, services, plant and tooling requirements, supply chains, material and product flow, continuous improvement and constraint and contingency management, occupational health and safety (OHS) and regulatory requirements.

## **Application of the Unit**

This unit applies to the design of manufacturing processes across all forms of manufacturing and engineering. Design activities may also include design rectification or modifications of an existing engineering-related manufacturing process. It is suitable for manufacturing system designers or manufacturing operations personnel, and those pursuing engineering or related qualifications and careers.

Prior or concurrent experience in production control techniques, manufacturing plant and processes, product and process improvement techniques, manufacturing plant and processes and evaluation of business performance, computing technology and mathematics is required.

The unit does not apply to technical leadership in project, operational or engineering management. Where these skills are required see unit MEM234001A Plan and manage engineering-related project or operations.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1		1.1	Clarify product performance objectives and specifications with client
		1.2	Determine parameters to the brief or contract
		1.3	Determine OHS, regulatory, sustainability and environmental issues relevant to the proposed manufacturing process
		1.4	Confirm client's production system capability and provide initial advice on feasibility
		1.5	Discuss 'time to market' issues with the client and establish timelines
		1.6	Decide, in conjunction with client, whether the proposed project should fit in with an existing production system or a new or redesigned process be established for the product
		1.7	Prepare a product development flow chart
2	Develop manufacturing process design options and prepare concept proposals	2.1	Analyse client's company's production system, if applicable
		2.2	Generate and validate a range of manufacturing process design solutions using current design methodologies that may include automated design tools
		2.3	Evaluate and rank options against client's criteria for

		quality, cost, application of automation, maintainability and regulatory requirements										
	2.4	Determine, social and sustainability implications of solutions										
	2.5	Document and present concept proposals to client										
	2.6	Provide feedback on product manufacturability										
	2.7	Evaluate concept proposals with client and select preferred process										
3	Design manufacturing process	<table><tr><td>3.1</td><td>Determine manufacturing process control, maintenance management, human resources and continuous improvement systems implications for final design</td></tr><tr><td>3.2</td><td>Finalise manufacturing process design, including material and product flow, logistics, transfers, new or modified facilities, services, plant and tooling layout</td></tr><tr><td>3.3</td><td>Ensure preparation of all required documentation, drawings, specifications and instructions</td></tr><tr><td>3.4</td><td>Consult with client and stakeholders to obtain sign-off on design</td></tr><tr><td>3.5</td><td>Monitor installation and commissioning of manufacturing process with stakeholders and make any necessary adjustments to design</td></tr></table>	3.1	Determine manufacturing process control, maintenance management, human resources and continuous improvement systems implications for final design	3.2	Finalise manufacturing process design, including material and product flow, logistics, transfers, new or modified facilities, services, plant and tooling layout	3.3	Ensure preparation of all required documentation, drawings, specifications and instructions	3.4	Consult with client and stakeholders to obtain sign-off on design	3.5	Monitor installation and commissioning of manufacturing process with stakeholders and make any necessary adjustments to design
3.1	Determine manufacturing process control, maintenance management, human resources and continuous improvement systems implications for final design											
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3.3	Ensure preparation of all required documentation, drawings, specifications and instructions											
3.4	Consult with client and stakeholders to obtain sign-off on design											
3.5	Monitor installation and commissioning of manufacturing process with stakeholders and make any necessary adjustments to design											

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of product performance objectives and specifications
- planning and designing manufacturing facilities, services, plant, tooling and process, and process control systems
- advising clients based on discipline knowledge and OHS and regulatory standards
- preparing a product development flow chart
- establishing budget and control measures and designing schedule within project control plan

- determining sustainability, OHS, regulatory and risk management requirements
- reviewing software options, facilities and logistics, services, labour, plant and tooling requirements
- modelling and calculating using automated design tools and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- incorporating maintenance management, human resources, information management and continuous improvement systems requirements
- implementing systems thinking, continuous improvement and constraint and contingency management options
- calculating estimated and actual time to market
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions
- investigating faults in existing manufacturing process designs and proposing solutions

## Required knowledge

Required knowledge includes:

- advanced and current manufacturing process design methodologies
- standardisation techniques
- economic, social and sustainability implications
- market competitiveness factors
- lean manufacturing principles
- automated design tools
- project planning, scheduling and control techniques, including budgeting and costing
- characteristics of, and differences between, jobbing, flexible and mass production, and continuous process
- implications of maintenance management and human resource systems for engineering-related planning processes
- production information flow required for and from a manufacturing process
- regulatory environment requirements, applicable standards and codes of practice
- process design documentation, drawings, specifications and instructions
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• plan and design manufacturing facilities, services, plant, tooling and process, and process control system</li> <li>• interpret features of product and processing options and parameters to the brief or contract</li> <li>• advise client based on discipline knowledge and OHS and regulatory standards</li> <li>• establish budget and control measures and design schedule within design project control plan</li> <li>• research current manufacturing process design techniques, product manufacturability, process design, layout and automation options, lean systems and supply chain value analysis</li> <li>• determine sustainability, OHS, regulatory and risk management requirements</li> <li>• review software options, facilities, services, plant and tooling requirements of products, stock control, warehousing, buffer and emergency stock, material and product flow, transfer operations, information flow and manufacturing process control, process maintenance management, labour requirements and skills distribution</li> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• incorporate maintenance management, HR, information management and continuous improvement systems</li> <li>• implement systems thinking, continuous improvement, and constraint and contingency management options</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with required drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• Full assessment of this unit would normally need to be undertaken on the job in the context of a commercial design project and software. Assessment of some elements of the manufacturing design process may be possible off the job providing full plant simulation facilities and software are</li> </ul>



	<p>available that reflect realistic workplace situations.</p> <ul style="list-style-type: none"> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Appropriate technical and professional assistance</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>• technical support and advice relating to elements which have</li> </ul>

	<p>intrinsic dangers, for example:</p> <ul style="list-style-type: none"> <li>• high pressure</li> <li>• energised fluid vessels</li> <li>• high temperatures and heat energy capacity</li> <li>• wiring or devices with high current or voltages above extra low voltage</li> <li>• professional support for technologies, such as: <ul style="list-style-type: none"> <li>• specialist electric motor drives and controllers</li> <li>• specialist materials, plastics, metal alloys and nano materials</li> <li>• special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> <li>• professional services for: <ul style="list-style-type: none"> <li>• finance, accounts and tax</li> <li>• insurance and legal</li> <li>• training and human resources (HR)</li> </ul> </li> </ul>
<b>Parameters to the brief</b>	<p>The design brief may include the design of new manufacturing processes or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• daily and seasonal production rates</li> <li>• requirements for shift work</li> <li>• provisions for increasing or reducing production rates</li> <li>• expected quality levels</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Production systems</b>	<p>Production systems may include:</p> <ul style="list-style-type: none"> <li>• suppliers</li> </ul>

	<ul style="list-style-type: none"> <li>• materials handling systems</li> <li>• manufacturing processes</li> <li>• labour force capability</li> <li>• distribution systems</li> </ul>
<b>Design methodologies</b>	<p>Design methodologies may include:</p> <ul style="list-style-type: none"> <li>• design for assembly</li> <li>• design for automated assembly</li> <li>• design for manufacturability</li> <li>• design for quality</li> <li>• design for maintainability</li> <li>• concurrent engineering</li> </ul>
<b>Automated design tools</b>	<p>Automated design tools may include:</p> <ul style="list-style-type: none"> <li>• computer-aided design (CAD)</li> <li>• computer-aided engineering (CAE)</li> <li>• solid modelling</li> <li>• finite element analysis</li> <li>• group technology (GT)</li> <li>• computer-aided process planning (CAPP)</li> <li>• expert system tools</li> <li>• cost analysis and financial modelling tools</li> </ul>
<b>Product manufacturability</b>	<p>Product manufacturability may be enhanced by concurrent product and process design. Product design for manufacturability includes:</p> <ul style="list-style-type: none"> <li>• consideration of manufacturing processes and plant in the product design process, such as the use of group technologies</li> </ul>
<b>Continuous improvement</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance.</p> <p>Continuous improvement techniques may include:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement system participation</li> <li>• technical training</li> </ul>

## **Unit Sector(s)**

Engineering practice

## **Custom Content Section**

Not applicable.

# MEM234014A Design a robotic system

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of an engineering application employing a robot and integrating it with other equipment and systems. It includes the use and integration of actuators, sensors, end effectors, including tactile effectors, dynamic analysis of strength and stability, programming and protocols for communications and networking, as appropriate.

## Application of the Unit

This unit applies to the design of a robotic system across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification, integration of off the shelf components, or modifications of an existing design. It is suitable for robotic system designers or maintenance technologists, and those pursuing qualifications and careers in engineering design involving robotics and automation.

Prior experience in the application of computing technology, mathematics, scientific principles and techniques, including kinematics and kinetics, electrical and fluid power principles and techniques, programming of computers and controllers, robotic systems evaluation and mechanical construction techniques is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Clarify client brief or contract requirements | 1.1 | Establish, in consultation with the client, the required features and functions of the the application and establish control requirements   |
|   |   | 1.2 | Determine technical, commercial and environmental parameters to the brief or contract   |
|   |   | 1.3 | Determine stakeholders to be consulted in the design and application process  |
|   |   | 1.4 | Provide initial advice to client on the feasibility of the project  |
| 2 | Prepare concept proposal                      | 2.1 | Investigate and take initial measurements to define robotic system performance parameters   |
|   |   | 2.2 | Carry out required modelling, simulations and calculations using appropriate techniques, software and validation techniques   |
|   |   | 2.3 | Generate a range of robotic system solutions that may include consideration of motions, loads, accuracy, precision and repeatability, kinematics, kinetics and dynamic stability, sensing, control, end effectors, data requirements, hardware requirements, system integration, network topology and communication protocols |
|   |   | 2.4 | Check feasibility and evaluate solutions against design criteria ensuring conformity to occupational health and safety (OHS), regulatory, sustainability and environmental requirements   |
|   |   | 2.5 | Review concept proposals with clients and select preferred solution   |

- |   |                                 |     |   |
|---|---------------------------------|-----|---|
| 3 | Design robotic device or system | 3.1 | Finalise design of robotic system   |
|   |                                 | 3.2 | Provide documentation, drawings, specifications and instructions  |
|   |                                 | 3.3 | Consult and negotiate with clients and stakeholders to obtain sign-off on design                              |
|   |                                 | 3.4 | Monitor installation and commissioning with stakeholders, when required, and make any necessary modifications |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of robots, robot functions, programming options and reverse engineering
- investigating and measuring, modelling and calculating for options
- investigating faults in existing designs and proposing solutions
- simulating and systematically programming and testing
- generating and evaluating a range of solutions for feasibility against design criteria
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- evaluating suitability of off the shelf components
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering for robot and robotic application design methods
- robotic fundamentals, including mechanical, electrical, fluid, electronic and information technologies, sensor/transducers, controllers, interfacing and signal conditioning, networking, software, data sharing and control functions

- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- processes for investigation, developing options, modelling and calculating, generating a range of solutions, completing feasibility and evaluation studies, and preparing proposals and designing
- software modelling techniques to analyse robot capability including motions, loads, accuracy, precision and repeatability, kinematics, kinetics and dynamic stability
- validation techniques, including use of simple case traditional methods and calculations:
  - robot drive systems
  - manipulators and end effector options
- fundamentals of locomotion for mobile robots, such as wheels, legs, combined leg and wheels and tracks:
  - object detection and sensor options
- program techniques for a range of robot functions, such as:
  - pick and place
  - proximity detection (presence and distance)
  - motion control algorithms
- system control and data acquisition (SCADA) or distributed control systems (DCS), communications methods and protocols, and networking requirements
- programs and programming techniques for robot functions, communications and networking, as required by design
- documentation, drawings, specifications, programs and instructions

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• consult and negotiate throughout the design process</li><li>• interpret features of the robotic system</li><li>• confirm parameters to the brief or contract and provide initial advice based on discipline knowledge, standards, OHS, regulatory and risk assessment requirements</li></ul>
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	<ul style="list-style-type: none"> <li>• research sustainability and current and emerging trends</li> <li>• investigate and review robotic concept proposals and performance parameters and options</li> <li>• measure, model and calculate using appropriate techniques, software and validation techniques</li> <li>• apply innovation and creativity to generate a range of solutions</li> <li>• evaluate solutions against design criteria ensuring conformity to OHS requirements</li> <li>• prepare robotic system proposal</li> <li>• design a robotic system</li> <li>• provide documentation, drawings, specifications and instructions</li> <li>• obtain sign-off on design.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>internal or external to the designer's organisation</li> </ul>
<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>determination of the degree of innovation and creativity expected by the client</li> <li>design process limits and budgets</li> <li>product cost limits and budgets</li> <li>performance specifications</li> <li>equipment availability, capacities and restrictions</li> <li>specified administrative, communication and approval procedures</li> <li>use and integration of off the shelf components</li> <li>other special features and limits in the design brief</li> </ul>
<b>Robotic system</b>	<p>A robotic system is a system that includes a self-controlling machine (robot) that can perform functions automatically without human initiation and assistance after initial programming and other components to allow integration with other equipment and systems within the workplace. The robot may have sensory elements, electrical, hydraulic or pneumatic actuators for linear or rotary motion and components to perform functions (e.g. grasping hands, lifting magnets and heating pads). The robot may be networked so as to serve an automated environment.</p> <p>Robots are usually programmed to perform repetitive tasks or tasks unsuitable for humans.</p>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>OHS Acts and regulations</li> <li>relevant standards</li> <li>industry codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>minimising ecological and environmental footprint of process, plant</li> </ul>

	<p>and product</p> <ul style="list-style-type: none"><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative OHS impact on employees, community and customer</li><li>• state and territory regulatory requirements</li></ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234015A Design hydronic heat exchanger systems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of hydronic heat exchanger systems using steam or water as the heat transfer medium. It includes boilers for heat generation, cooling towers and chillers for heat dissipation.

## Application of the Unit

This unit applies to the design of hydronic heat exchanger systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for hydronic system contractors, building heating, ventilation and air conditioning (HVAC) consultants, designers and maintenance personnel.

Prior experience in the evaluation of hydronic systems, application of heating, ventilation, air conditioning and refrigeration (HVAC/R) principles, mathematics and computer techniques is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Clarify the design brief and specifications for the hydronic heat exchanger system	1.1	Establish required features and performance parameters of a hydronic heat exchanger system
		1.2	Confirm technical, commercial and environmental parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess occupational health and safety (OHS), regulatory, sustainability or environmental issues relevant to the design task
		1.5	Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2	Evaluate design analysis and prepare concept proposals	2.1	Appraise initial qualitative and quantitative analysis of the design task
		2.2	Carry out required detailed modelling and calculations using appropriate software and validation techniques appropriate to given environments
		2.3	Generate a range of solutions to the design brief for a hydronic heat exchange system
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, air quality, environmental and sustainability requirements.
		2.5	Present concept proposals to client and select preferred solution
3	Design hydronic system	3.1	Develop a hydronic system design
		3.2	Provide documentation, drawings, specifications and instructions
		3.3	Consult with client and stakeholders to obtain sign-off

on design

- 3.4 Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- determining OHS, regulatory and risk management requirements
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- designing hydronic heat exchange systems, including selection of boilers, pumps, cooling towers and chillers, as required using current design methods
- investigating faults in existing designs and arriving at solutions
- communicating, consulting, negotiating and reviewing with client and stakeholders
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary engineering design methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- documenting design with drawings, specifications and instructions required
- OHS, regulatory and environmental requirements for work areas and refrigerated spaces, standards, codes of practice, risk management and organisational procedures related to HVAC/R design, installation, operation and maintenance
- concepts of thermodynamics, hydronics, properties of substances, conservation of mass and energy principles
- heat transfer (e.g. conduction, convection and radiation)

- heat exchangers
- water chillers
- pumping systems and cavitation
- practical pump installations and operation problems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• design hydronic systems</li> <li>• apply safe working practices and procedures</li> <li>• communicate, consult, negotiate and review with client and stakeholders</li> <li>• research and respond to current issues</li> <li>• measure and investigate site and system requirements</li> <li>• model and calculate</li> <li>• use appropriate software and validation techniques</li> <li>• innovate and create for a range of solutions incorporating systems thinking, continuous improvement, and constraint and contingency management</li> <li>• evaluate solutions against design criteria</li> <li>• conform to OHS, environmental and sustainability requirements</li> <li>• obtain sign-off on design</li> <li>• document, produce graphics and drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with</li> </ul>

	disabilities.
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Hydronic heating systems</b>	Hydronic heating systems generally use a boiler to heat water which is then pumped through piping to panel radiators which are installed in each area requiring heating. Heat then transfers from the panel in each room by natural convection
<b>Parameters to the design brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> </ul>



	<ul style="list-style-type: none"> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Given environments</b>	<p>Given environments may include:</p> <ul style="list-style-type: none"> <li>• workplaces</li> <li>• food halls</li> <li>• restaurants</li> <li>• hotels</li> <li>• hospitals</li> <li>• domestic dwellings</li> <li>• industrial sites, factories, warehouses and cold storage areas</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task</p>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234016A Design refrigeration systems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of industrial and commercial refrigeration systems and system components. It includes industrial systems with multiple evaporators and compressors, moderate and low temperature, indirect refrigeration and flooded systems, commercial refrigeration and food storage technology, and compliance with safety and regulatory requirements.

## Application of the Unit

This unit applies to the design of refrigeration systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. It is suitable for refrigeration system contractors, heating, ventilation, air conditioning and refrigeration (HVAC/R) consultants, designers and maintenance personnel.

Prior experience in the application of HVAC/R principles, evaluation of HVAC/R systems and thermal loads, mathematics and computer techniques is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Clarify the design task and elaborate the specification | 1.1 | Establish, in consultation with client, required features of refrigeration system and system components  |
|   |   | 1.2 | Determine parameters to the brief or contract  |
|   |   | 1.3 | Determine stakeholders to be consulted in design process   |
|   |   | 1.4 | Assess occupational health and safety (OHS), regulatory, sustainability or environmental issues relevant to design task                                |
|   |   | 1.5 | Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility   |
| 2 | Prepare concept proposal                                | 2.1 | Analyse and undertake initial investigations to define refrigeration systems and system components performance parameters                              |
|   |   | 2.2 | Carry out required modelling, simulations and calculations using appropriate techniques, software and validation techniques                            |
|   |   | 2.3 | Generate a range of refrigeration system solutions   |
|   |   | 2.4 | Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements |
|   |   | 2.5 | Review concept proposals with clients and select preferred solution  |
| 3 | Design refrigeration system                             | 3.1 | Finalise selected refrigeration system design  |
|   |   | 3.2 | Provide documentation, drawings, specifications and instructions   |
|   |   | 3.3 | Consult and negotiate with clients and stakeholders to   |

obtain sign-off on design

- 3.4 Monitor installation and commissioning with stakeholders, when required, and make any necessary modifications

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- interpreting standards
- researching latest trends and techniques in design of industrial and commercial refrigeration systems and system components
- investigating and measuring, modelling and calculating for options
- investigating faults in existing designs and arriving at solutions
- simulating and systematically programming and testing
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and analysis
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary refrigeration system design methods
- research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- OHS, regulatory and environmental requirements for work areas and refrigerated spaces, standards, codes of practice, risk management and organisational procedures related to HVAC/R design, installation, operation and maintenance

- general refrigeration systems and components
- commercial and industrial refrigeration systems and components
- refrigeration system analysis, arrangement and simulation software, use and validation
- principles of food storage technology
- controlling and managing risks associated with food storage
- food processing techniques (types of heat and chill processing techniques)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• design refrigeration systems and system components</li> <li>• apply safe working practices and procedures</li> <li>• communicate, consult, negotiate and review with client and stakeholders</li> <li>• research and respond to current issues</li> <li>• measure and investigate site and system requirements</li> <li>• model and calculate</li> <li>• use appropriate software and validation techniques</li> <li>• innovate and create for a range of solutions incorporating systems thinking, continuous improvement and constraint and contingency management</li> <li>• evaluate solutions against design criteria</li> <li>• conform to OHS requirements</li> <li>• obtain sign-off on design</li> <li>• document, produce graphics and drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or</li> </ul>

	assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Refrigeration systems and components</b>	Refrigeration systems and system components include: <ul style="list-style-type: none"> <li>• industrial systems with multiple evaporators and compressors, moderate and low temperature, indirect refrigeration and flooded systems, commercial refrigeration and food storage technology and compliance with safety and regulatory requirements</li> </ul>
<b>Parameters to the brief</b>	The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include: <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> </ul>

	<ul style="list-style-type: none"> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234017A Design exhaust, ventilation and dust collection systems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the design of commercial and industrial exhaust, ventilation and dust extraction systems in accordance with standards, codes and regulatory requirements. It includes fluid dynamic principles and selection of system components, such as ducting, fans and filters.

## Application of the Unit

This unit applies to the design of exhaust, ventilation and dust collection systems across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for exhaust, ventilation and dust collection system contractors, consultants, designers and maintenance personnel.

Prior experience in the application of thermo and fluid dynamic principles, mathematics and computer techniques is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills



unit of competency. and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Clarify the design task and elaborate the specification | 1.1 Establish, in consultation with client, features of exhaust, ventilation and dust collection plant and equipment, and performance parameters<br><br>1.2 Determine parameters to the brief or contract<br><br>1.3 Determine stakeholders to be consulted in design process<br><br>1.4 Assess occupational health and safety (OHS), regulatory, sustainability or environmental issues relevant to design task<br><br>1.5 Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility   |
| 2 | Prepare concept proposal                                | 2.1 Analyse and undertake initial investigations to define exhaust, ventilation and dust collection plant and equipment performance parameters<br><br>2.2 Carry out required modelling, simulations and calculations using appropriate techniques, software and validation techniques<br><br>2.3 Generate a range of exhaust, ventilation and dust collection plant and equipment solutions<br><br>2.4 Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements<br><br>2.5 Review concept proposals with clients and select preferred solution |
| 3 | Design exhaust, ventilation and dust collection         | 3.1 Develop selected exhaust, ventilation and dust collection system designs<br><br>3.2 Provide documentation, create computer-aided design  |

system	(CAD) graphics or models, drawings, specifications and instructions
3.3	Consult with client and stakeholders to obtain sign-off on design
3.4	Monitor installation and commissioning with stakeholders, when required, and make any necessary modifications

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining the features and functions of the exhaust, ventilation and dust extraction systems, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- interpreting standards
- researching latest trends and techniques in design of exhaust, ventilation and dust collection plant and equipment systems
- investigating and measuring, modelling and calculating for design options
- investigating faults in existing designs and proposing solutions
- simulating and systematically programming and testing design options
- generating a range of solutions and evaluating them for feasibility against design criteria, engineering practice and financial analysis
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

### Required knowledge

Required knowledge includes:

- contemporary design methods, research and investigation methods for exhaust, ventilation and dust collection plant and equipment
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review

based on failure mode (DRBFM), and Pareto analysis

- documentation, drawings, specifications and instructions required
- OHS, regulatory and environmental requirements for work areas, standards, codes of practice, risk management and organisational procedures related to the design, installation, operation and maintenance of exhaust, ventilation and dust collection systems
- current options and trends in design, performance analysis, and modelling and simulation software, including software validation techniques
- concepts of exhaust, ventilation and dust collection
- system analysis, 3-D arrangement, manufacturing data and simulation software, use and validation
- fans, selection and application
- ducting design:
  - system sizing and balancing methods
  - air diffusers, outlet design and location
- dust collection systems, selection and application
- system issues:
  - air quality
  - noise attenuation and sound proofing
  - flame proofing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• design exhaust, ventilation and dust collection systems</li> <li>• apply safe working practices and procedures</li> <li>• communicate, consult, negotiate and review with client and stakeholders</li> <li>• research and respond to issues</li> <li>• measure and investigate sites</li> <li>• investigate options</li> <li>• model and calculate system performance</li> <li>• innovate and create a range of solutions incorporating systems thinking, continuous improvement and constraint and contingency management</li> <li>• obtain sign-off on design</li> <li>• document, create computer-aided design (CAD) graphics, and</li> </ul>
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	specify and develop instructions.
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Client</b>	Client may be:
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	<ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>Parameters to the brief</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>OHS, regulatory, sustainability and environmental issues</b>	<p><b>OHS, regulatory, sustainability and environmental issues</b> may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task</p>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234018A Design heating, ventilation, air conditioning and refrigeration control systems**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the design of heating, ventilation, air conditioning and refrigeration (HVAC/R) control and energy management systems. It includes the selection of control system elements to suit HVAC/R environmental and hardware control requirements and development of an energy management plan.

## **Application of the Unit**

This unit applies to the design of control systems and energy management plans across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for refrigeration system contractors, HVAC/R consultants, designers and senior maintenance personnel.

Prior or concurrent experience in the evaluation of HVAC/R control systems, hydronic and refrigeration systems and thermal loads, electrical principles, controller programming and computing is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Clarify the design brief and specifications for HVAC/R control system | 1.1 | Establish required features and performance parameters of HVAC/R control system   |
|   |   | 1.2 | Confirm technical, commercial and environmental parameters to the brief or contract   |
|   |   | 1.3 | Determine stakeholders to be consulted in design process  |
|   |   | 1.4 | Assess occupational health and safety (OHS), regulatory, sustainability or environmental issues relevant to the design task                           |
|   |   | 1.5 | Confirm design brief including budget and schedule and provide preliminary advice on feasibility  |
| 2 | Evaluate design analysis and prepare concept proposals                | 2.1 | Appraise initial qualitative and quantitative analysis of the design task   |
|   |   | 2.2 | Carry out required detailed modelling and calculations using appropriate software and validation techniques appropriate to given environments         |
|   |   | 2.3 | Generate a range of solutions to the design brief for an HVAC/R control system and associated energy management plan                                  |
|   |   | 2.4 | Integrate building management systems (BMS) considerations into the design, where required  |
|   |   | 2.5 | Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements |
|   |   | 2.6 | Determine social and sustainability implications of solutions   |
|   |   | 2.7 | Present concept proposals to client   |

- |   |                              |     |   |
|---|------------------------------|-----|---|
| 3 | Design HVAC/R control system | 3.1 | Evaluate concept proposals with client  |
|   |                              | 3.2 | Ensure that design solution is optimised with respect to the system specifications                    |
|   |                              | 3.3 | Finalise selected design, including equipment, layout and fluid requirements                          |
|   |                              | 3.4 | Ensure preparation of all required documentation, drawings, specifications and instructions           |
|   |                              | 3.5 | Consult with client and stakeholders to obtain sign-off on design                                     |
|   |                              | 3.6 | Monitor installation and commissioning with stakeholders and make any necessary adjustments to design |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required knowledge includes:

- interpreting features of plant and equipment, and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- investigating faults in existing designs and arriving at solutions
- determining OHS, regulatory and risk management requirements
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- designing HVAC/R control system and energy management plans using current design methods
- programming building control systems software
- communicating, consulting, negotiating and reviewing with client, stakeholders, experts, licensed technical and professional services
- documenting design with drawings, specifications and instructions

### Required knowledge



Required knowledge includes:

- contemporary engineering design methods
- HVAC/R control systems techniques
- energy management principles
- relevant engineering design methods
- design, research, modelling and computational methodologies applied the HVAC/R control systems
- design methods, research and investigations methods
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- control system principles applied to HVAC/R systems
- types of control equipment
- system hardware requirements, such as industrial and commercial refrigeration systems, hydronic systems and automated controls
- HVAC/R load cycles
- BMS principles
- energy options, such as unit tariffs, system and component consumption, benchmarks for energy costs and comparative tariffs of supply authorities
- interface principles for system components
- building management control system software
- major system hardware component control and energy requirements
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• design control system and energy management plans</li><li>• apply safe working practices and procedures</li><li>• conform to OHS, regulatory and environmental requirements, standards, codes of practice, risk management and</li></ul>
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	<p>organisational procedures</p> <ul style="list-style-type: none"> <li>• investigate and interpret brief and options</li> <li>• communicate, consult, negotiate and review with client, stakeholders, experts, and licensed technical and professional services</li> <li>• research current issues, sustainability implications, control system and energy management options, software and programming techniques</li> <li>• measure and investigate for initial proposals</li> <li>• model and calculate</li> <li>• use judgement and discretion</li> <li>• use appropriate software and validation techniques</li> <li>• innovate and create for a range of solutions incorporating systems thinking, continuous improvement and constraint and contingency management</li> <li>• evaluate solutions against design criteria</li> <li>• conform to OHS requirements</li> <li>• obtain sign-off on design</li> <li>• document and produce graphics and drawings, specifications and instructions.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> </ul>

	<ul style="list-style-type: none"><li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment may be in conjunction with assessment of other units of competency where required.</li></ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>HVAC/R control system</b>	<p>System components may include:</p> <ul style="list-style-type: none"><li>• human machine interfaces</li><li>• web servers, network topology and bus systems</li><li>• protocols</li><li>• system or network controllers</li><li>• programmable logic controllers (PLCs)</li><li>• terminal unit controllers for major plant components, such as boilers and HVAC/R central plant air handlers, chilled and hot water valves, air dampers, supply fans and lighting</li><li>• analog and digital input/output (I/O)</li><li>• remote control systems, including ethernet options</li></ul>
<b>Parameters to the brief or contract</b>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>Parameters to the design brief may include:</p> <ul style="list-style-type: none"><li>• determination of the degree of innovation and creativity expected by the client</li><li>• design process limits and budgets</li><li>• product cost limits and budgets</li><li>• performance specifications</li><li>• equipment availability, capacities and restrictions</li><li>• specified administrative, communication and approval procedures</li><li>• other special features and limits in the design brief</li></ul>

<b>OHS, regulatory, sustainability or environmental issues</b>	<p><b>OHS, regulatory, sustainability or environmental issues</b> may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• minimising ecological and environmental footprint of process, plant and product</li> <li>• maximising economic benefit of process plant and product to the organisation and the community</li> <li>• minimising the negative OHS impact on employees, community and customer</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Given environments</b>	<p>Given environments may include:</p> <ul style="list-style-type: none"> <li>• workplaces</li> <li>• food halls</li> <li>• restaurants</li> <li>• hotels</li> <li>• hospitals</li> <li>• domestic dwellings</li> <li>• industrial sites, factories, warehouses and cold storage areas</li> <li>• transport and refrigerated vehicles and trains</li> </ul>
<b>Range of solutions</b>	<p>Range of solutions may include solutions that:</p> <ul style="list-style-type: none"> <li>• satisfy the technical requirements of the design brief</li> <li>• are within budget</li> <li>• are able to be manufactured</li> <li>• meet any regulatory requirements</li> <li>• minimise environmental and sustainability impacts</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task</p>
<b>Client</b>	<p>Client may be:</p> <ul style="list-style-type: none"> <li>• internal or external to the designer's organisation</li> </ul>
<b>System specifications</b>	<p>System specifications may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• ducts and duct systems: <ul style="list-style-type: none"> <li>• materials</li> <li>• supports</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• factory and field fabricated</li><li>• sealants</li><li>• layout and placements</li><li>• capacity</li><li>• zoning</li><li>• heating and cooling loads</li><li>• air flow and pressures</li><li>• refrigerants</li><li>• energy efficiency</li><li>• air intake points</li><li>• control equipment</li><li>• monitoring equipment</li></ul>
<b>Energy management plan</b>	An energy management plan is a planning document that acts as a single source for all the critical information, steps, resources and methods you need to make efficient and effective movement to improved energy management and reduce energy consumption
<b>BMS</b>	BMS include: <ul style="list-style-type: none"><li>• HVAC/R control systems and may also include fire, security and lighting controls</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234019A Apply finite element analysis in engineering design

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the application of finite element analysis (FEA) for engineering design and modification analyses, including stress analysis, displacements and natural frequencies, and temperature and heat distributions in engineering or related applications.

## Application of the Unit

This unit applies to engineering or related applications across all forms of manufacturing and engineering. It is suitable for people with structural, plant or equipment design or maintenance responsibilities, and those pursuing engineering or related qualifications and careers.

Prior experience in mechanics, mathematics and computing techniques and computer-aided design (CAD) is required and areas, such as thermodynamics or structures, depending on the application of the FEA.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Integrate requirement for FEA into an engineering design application	1.1	Establish functions, features and performance parameters of plant, structure or equipment to be analysed
		1.2	Determine parameters to the brief or contract
		1.3	Determine occupational health and safety (OHS), regulatory, sustainability and environmental requirements of the application
		1.4	Provide initial advice based on discipline knowledge, OHS and regulatory standards relating to the suitability of using FEA as an analytical technique
2	Apply FEA solution techniques	2.1	Set up a finite element model, including internal and external parameters, element mesh and nodes
		2.2	Select appropriate solver and adjust parameters for optimum solution
		2.3	Generate and assess solution file for warnings or errors
		2.4	Interpret results and generate graphics
		2.5	Identify areas of excessive stress, deformation, instability and excessive temperatures
		2.6	Verify results to the required certainty level
		2.7	Apply systems or holistic thinking, contingencies and constraints management, problem solving and decision making techniques in making recommendations to achieve satisfactory functions, features and performance parameters
		2.8	Review initial results with client
		2.9	Negotiate adjustments to brief or contract parameters, if required
3	Embed FEA	3.1	Report and recommend design improvements or

results in design  
application

modifications as a result of the FEA analysis

3.2 Document results of investigations, analysis and  
recommendations

3.3 Obtain sign-off

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- gathering information relevant to the FEA task
- interpreting and evaluating documentation, specifications and drawings for FEA purposes
- researching FEA, mathematical techniques, applicability and limitations, software and evolving opportunities for FEA
- setting up FEA model, parameters, element mesh and nodes
- using FEA software, including pre- and post-processor, if any, effectively
- constructing models of engineering part or structure suitable for FEA using appropriate software
- determining and setting parameters and conditions for required type of analysis
- applying boundary conditions to suit type of analysis required, including axisymmetric analysis
- choosing, setting up, and running appropriate solvers, such as linear static, linear buckling, non-linear static, natural frequency, steady state, heat, and so on
- interpreting results, generating graphics and identifying significant issues
- validating software outputs
- reporting and documenting results

### Required knowledge

Required knowledge includes:

- FEA task parameters for applications, such as:
  - stresses and displacements
  - natural frequencies
  - heat and temperature distribution
- software modelling and validation techniques, including:
  - element type and shape for error minimisation
  - library files



- geometry importation from other software packages
- application of boundary conditions
- validation using comparison with traditional solution of simple examples and reviewing of past successful applications
- methods for presentation of results, including software-generated graphics
- measures of excessive stress and/or deformation and to recommend modifications
- software functions and features, such as:
  - deformed displays
  - colour contour plots, contour averaging and contour jumps
  - peeking, graphing and animating
  - multiple views
- coordinate systems:
  - Cartesian
  - polar
  - spherical coordinate systems
- stress concentrations
- structural loads:
  - dead loads, live loads and wind loads
  - structural and non-structural mass
- material libraries:
  - types of beam, plate and brick elements
  - properties of materials, such as stress, strain, modulus of elasticity, modulus of rigidity, Poisson's ratio and allowable stress
- stresses:
  - equivalent stresses based on Von Mises criterion and Tresca criterion
  - shear force and bending moment diagrams, bending stress and torsional stress
  - heat transfer modes (conduction, convection and radiation)
  - thermal stress
- accuracy checking methods, including use of strain gauges and solvers
- software validation techniques

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence	Assessors must be satisfied that the candidate can competently and consistently:
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required to demonstrate competency in this unit	<ul style="list-style-type: none"> <li>• determine functions, features and performance parameters of plant, structure or equipment to be analysed</li> <li>• determine parameters to the brief or contract, OHS, regulatory, risk management and sustainability requirements</li> <li>• communicate, advise, negotiate and review with stakeholders and client throughout process</li> <li>• apply FEA solution techniques</li> <li>• set up FEA model, parameters, element mesh and nodes</li> <li>• select solver and adjust and optimise parameters</li> <li>• generate and assess solution file</li> <li>• interpret results, generate graphics and identify significant issues</li> <li>• validate software outputs</li> <li>• apply systems or holistic thinking, contingencies and constraints management, problem solving and decision making techniques in making recommendations</li> <li>• report and document results.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>FEA</b>	FEA uses numerical techniques to find approximate solutions for engineering problems, such as: <ul style="list-style-type: none"> <li>• load, stiffness and deflection analysis and animations for vehicle crash simulations</li> <li>• hopper and bin designs</li> <li>• piping systems</li> <li>• heat flow, such as in in cavity moulds, load distribution, stiffness and strength in structures</li> </ul>
<b>Parameters to the brief</b>	The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include: <ul style="list-style-type: none"> <li>• determination of the degree of innovation and creativity expected by the client</li> <li>• design process limits and budgets</li> <li>• product cost limits and budgets</li> <li>• performance specifications</li> <li>• equipment availability, capacities and restrictions</li> <li>• specified administrative, communication and approval procedures</li> <li>• other special features and limits in the design brief</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
<b>OHS, regulatory, sustainability and environmental requirements</b>	<b>OHS, regulatory, sustainability and environmental requirements</b> may include: <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> </ul>

	<ul style="list-style-type: none"><li>• registration requirements</li><li>• safe work practices</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative OHS impact on employees, community and customer</li><li>• state and territory regulatory requirements</li></ul>
<b>Appropriate solver</b>	Appropriate solver may include: <ul style="list-style-type: none"><li>• sparse</li><li>• preconditioned conjugate gradient (PCG)</li><li>• incomplete cholesky conjugate gradient</li><li>• frontal</li></ul>
<b>Client</b>	Client may be: <ul style="list-style-type: none"><li>• internal or external to the organisation</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## **MEM234020A Coordinate small lot manufacture using rapid manufacture processes**

### **Modification History**

New Unit

### **Unit Descriptor**

This unit of competency covers the coordination of rapid manufacture (RM), rapid prototyping (RP) and rapid tooling (RT) processes for single or small lot production. It includes choice of materials, machinery and processes, generation of data and post-processing.

### **Application of the Unit**

This unit applies to the RM of components or prototypes across all forms of manufacturing and engineering. It is suitable for manufacturing maintenance technicians, component and tool designers, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of computer-aided design (CAD), computing technology, mathematics, scientific principles and techniques, materials, methods, processes and mechanical construction techniques is required.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Clarify the production task and elaborate the specifications | 1.1 | Determine features of object to be produced  |
|   |  | 1.2 | Determine parameters for the process and production and provide initial advice based on knowledge of rapid processes                   |
|   |  | 1.3 | Assess occupational health and safety (OHS) and regulatory requirements, codes of practice, standards and risk management requirements |
|   |  | 1.4 | Confirm object parameters with client  |
| 2 | Prepare software model and relevant data files for object    | 2.1 | Check or create initial CAD model using appropriate modelling software   |
|   |  | 2.2 | Select an appropriate rapid processing technology for object implementation  |
|   |  | 2.3 | Ensure that CAD model data has been pre-processed and the required files have been created for given rapid processing equipment        |
|   |  | 2.4 | Determine social and sustainability implications of solution   |
| 3 | Finalise and direct production of first-off prototype        | 3.1 | Finalise selected process ensuring preparation of all required programming and documentation   |
|   |  | 3.2 | Direct test run first-off sample   |
|   |  | 3.3 | Obtain sign-off on sample by client  |
|   |  | 3.4 | Direct production of batch quantity of objects, as required  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting features of object, materials, machinery and processes, and parameters for rapid processes
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial rapid production techniques
- determining OHS, regulatory and risk management requirements
- investigating, measuring and considering options
- modelling and calculating using appropriate software and validation techniques
- designing components and process adaptations
- communicating, negotiating and reviewing with stakeholders and client throughout object development and manufacture
- documenting process with drawings, specifications and instructions, and storing appropriate data files

### Required knowledge

Required knowledge includes:

- technical and professional support services required to comply with ethical, license, legal and indemnity requirements
- economic, social and environmental implications of rapid processes
- OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- factors affecting prototype material, machine and process selection
- current developments in machine and process capabilities for direct and indirectly manufactured components or tools
- machine data, including:
  - data digitising
  - reverse engineering
  - CAD and CAD files:
    - CAD functions, features and techniques related to RP
    - CAD model requirements for effective post-processing and suitability for the rapid process
    - file formats: .STL
  - post-processing
- current developments in materials:
  - materials for additive printing processes

- materials for sprayed metal deposition
- materials for rapid casting
- other materials, for example:
  - thermoplastics for vacuum forming
  - materials for rapid machining and fabrication
- documentation, drawings, specifications and instructions required, process information and programming

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• coordinate small lot manufacture using RM processes</li> <li>• apply RM principles and processes</li> <li>• interpret features of objects, materials, machinery and processes and parameters for rapid processes</li> <li>• advise client based on discipline knowledge and OHS and regulatory standards</li> <li>• research sustainability implications and current industrial design techniques</li> <li>• determine OHS, regulatory and risk management requirements</li> <li>• investigate and measure</li> <li>• model and calculate using appropriate software and validation techniques</li> <li>• generate and evaluate a range of solutions for feasibility against design criteria</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, specifications and instructions, and store appropriate data files</li> <li>• produce a batch quantity of objects.</li> </ul>
<p>Context of and specific resources for assessment</p>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone</li> </ul>



	<p>or as part of a team.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RM applications</b>	<p>RM applications are found in a variety of industries and for a number of purposes, including products requiring a high degree of customisation, or where speed to market is critical. Examples of rapid manufacturing or 'mass customisation' applications include:</p> <ul style="list-style-type: none"> <li>• medical and dental prosthetics and implants</li> <li>• customised components for automotive, aerospace, marine and general product manufacture</li> <li>• jewellery and other art objects</li> </ul>
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	<ul style="list-style-type: none"> <li>any small to medium quantity item, particularly involving high set-up cost associated with using alternative or traditional methods</li> </ul>
<b>Rapid Prototyping (RP) applications</b>	<p>RP is typically developed for:</p> <ul style="list-style-type: none"> <li>concept modelling and multiple design iterations at low cost</li> <li>form, fit and function testing prior to committing to expensive tooling</li> </ul>
<b>Rapid Tooling (RT) applications</b>	<p>RT applications include:</p> <ul style="list-style-type: none"> <li>tooling for most RM components. Both ‘direct’ and ‘indirect’ methods may be used to produce the tool</li> </ul>
<b>OHS and regulatory requirements, codes of practice, standards and risk management requirements</b>	<p>OHS and regulatory requirements, codes of practice, standards and risk management requirements may include:</p> <ul style="list-style-type: none"> <li>OHS Acts and regulations</li> <li>relevant standards</li> <li>industry codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements applying to electrical work</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular rapid processing task</p>
<b>Sustainability</b>	<p>Sustainability is used to mean the entire sustainable performance of the organisation/plant, including:</p> <ul style="list-style-type: none"> <li>meeting all regulatory requirements</li> <li>conforming to all industry covenants, protocols and best practice guides</li> <li>minimising ecological and environmental footprint of process, plant and product</li> <li>maximising economic benefit of process plant and product to the organisation and the community</li> <li>minimising the negative OHS impact on employees, community and customer</li> </ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234021A Apply statistics to technology problems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the application of advanced statistics in an engineering or related application. It includes probability distributions, correlation, inference and significance, and covers both the application of theory in simple calculations and the use of relevant statistical packages for more complex situations.

## Application of the Unit

This unit applies to projects or tasks requiring advanced statistical analysis involving probability distributions, correlation, inference and significance, and the use of statistical tables and equations, either manually or through use of an appropriate statistics package. It is suitable for paraprofessionals and technologists required to solve advanced statistical problems in an engineering or related field, or those pursuing technologist careers and qualifications.

Prior or concurrent experience in probability and statistics covering central tendency, measures of variability and confidence limits is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Identify a need for the application of statistics | 1.1 | Identify a problem requiring a statistical application                   |
|   |   | 1.2 | Define the problem   |
|   |   | 1.3 | Determine data currently available for analysis                          |
|   |   | 1.4 | Determine information required from outcome                              |
| 2 | Prepare to solve statistical problem              | 2.1 | Determine statistical techniques to be applied                           |
|   |   | 2.2 | Identify and gain access to appropriate computational devices            |
|   |   | 2.3 | Collect required input data  |
|   |   | 2.4 | Analyse collected data for suitability and completeness                  |
|   |   | 2.5 | Take appropriate action to address any deficiencies found                |
| 3 | Solve statistical problem                         | 3.1 | Apply appropriate techniques to collected data                           |
|   |   | 3.2 | Check answer by appropriate means  |
|   |   | 3.3 | Interpret answer to determine information required by problem definition |
| 4 | Communicate outcomes                              | 4.1 | Communicate outcome to relevant stakeholders by appropriate means        |
|   |   | 4.2 | Explain outcome to stakeholders, as appropriate                          |
|   |   | 4.3 | Check outcome has addressed problem                                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and defining problems
- collecting and analysing data
- reporting and presenting data and quantitative information
- communicating effectively with stakeholders on problem resolution

### Required knowledge

Required knowledge includes:

- discrete and continuous data
- presentation data:
  - frequency distribution tables
  - histograms
  - ogives
- measures of central tendency:
  - arithmetic mean
  - median
  - mode
- measures of dispersion:
  - standard deviation
  - range
  - interquartile range
- probability
  - probability laws
  - probability distributions (binomial, and normal)
  - random walk and Monte Carlo methods
- statistical inference
  - large and small samples
  - sample size
  - statistical significance (student t, paired difference and two populations)
  - short cut methods (rank-sum, run tests and Kolmogorov-Smirnov)
- linear regression and correlation
- analysis of variance:
  - one way, two way and multiple

- factorial experiments
- failure time distributions
- reliability and life testing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify appropriate statistical techniques for engineering or related problems</li> <li>• apply the appropriate technique to the problem</li> <li>• communicate the outcome of the analysis in an appropriate way.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competency covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>

	<ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Problem definition</b>	A problem definition for the purposes of this unit is one that allows for a statistical analysis and the application of quantitative data
<b>Data available</b>	Data currently available includes: <ul style="list-style-type: none"> <li>all relevant data which is currently available within the organisation or could be readily obtained</li> </ul>
<b>Information required</b>	Information required is: <ul style="list-style-type: none"> <li>the outcome which needs to be produced in order to solve/assist in resolving the defined problem</li> </ul>
<b>Statistical techniques</b>	Statistical technique may include: <ul style="list-style-type: none"> <li>one or more or any of the techniques listed under 'required knowledge'</li> <li>a related technique</li> </ul>
<b>Computational device</b>	Computational devices include: <ul style="list-style-type: none"> <li>calculators with statistical functions</li> <li>computer software packages</li> </ul>
<b>Appropriate action</b>	Appropriate action may include: <ul style="list-style-type: none"> <li>taking necessary steps to obtain required data</li> <li>obtaining some relevant proxy for the desired data</li> <li>choosing a different statistical technique/computational device which will function with available data</li> </ul>
<b>Appropriate technique</b>	Appropriate technique includes: <ul style="list-style-type: none"> <li>selected statistical technique which will yield required outcome</li> <li>technique which is appropriate for the available data and which is relevant to the problem</li> </ul>



<b>Check answer</b>	Checking answer means that the answer is examined to ensure it is within the range of expected rational results
<b>Interpret answer</b>	Interpret answer means translating the result of the statistical analysis into a form which is useable by the relevant stakeholders
<b>Appropriate communication</b>	Appropriate communication may include: <ul style="list-style-type: none"><li>• report</li><li>• presentation</li><li>• verbal communication</li><li>• web-based</li><li>• electronic or hard copy</li></ul>
<b>Check outcome</b>	Check outcome includes: <ul style="list-style-type: none"><li>• ensuring that the result of the analysis does assist in the resolution of the problem</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## MEM234022A Apply advanced calculus to technology problems

### Modification History

New unit

### Unit Descriptor

This unit of competency covers the application of advanced calculus in an engineering or related application. It includes differential and integral calculus and covers both the application of theory in simple calculations and the use of relevant software packages for more complex situations.

### Application of the Unit

This unit applies to projects or tasks requiring advanced calculus, either manually or through use of an appropriate software package. It is suitable for paraprofessionals and technologists required to solve advanced mathematical problems in an engineering or related field, or those pursuing technologist careers and qualifications.

Prior or concurrent experience in mathematics covering calculus and differentials is required.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Identify a need for the application of calculus | 1.1 | Identify a problem requiring application of calculus                     |
|   |   | 1.2 | Define the problem   |
|   |   | 1.3 | Determine data currently available for analysis                          |
|   |   | 1.4 | Identify ways of obtaining other required data                           |
|   |   | 1.5 | Determine information required from outcome                              |
| 2 | Prepare to solve problem by calculus            | 2.1 | Determine appropriate calculus to be applied                             |
|   |   | 2.2 | Identify and gain access to appropriate computational devices            |
|   |   | 2.3 | Collect required input data  |
|   |   | 2.4 | Analyse collected data for suitability and completeness                  |
|   |   | 2.5 | Take appropriate action to address any deficiencies found                |
| 3 | Solve problem using calculus                    | 3.1 | Apply appropriate technique to collected data                            |
|   |   | 3.2 | Check answer by appropriate means  |
|   |   | 3.3 | Interpret answer to determine information required by problem definition |
| 4 | Communicate outcomes                            | 4.1 | Communicate outcome to relevant stakeholders by appropriate means        |
|   |   | 4.2 | Explain outcome to stakeholders, as appropriate                          |
|   |   | 4.3 | Check outcome has addressed problem                                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and defining problems
- collecting and analysing data
- reporting and presenting data and quantitative information
- communicating effectively with stakeholders on problem resolution

### Required knowledge

Required knowledge includes:

- differential calculus:
  - introduction - review of standard derivatives and rules:
    - power rule
    - product rule
    - quotient rule
    - chain or function of a function rule
    - standard derivatives for a variety of common functions
  - higher order derivatives
  - graph sketching
  - maxima and minima (optimisation)
  - rates of change
  - small increments (errors and approximations)
  - implicit differentiation
  - logarithmic differentiation
  - partial differentiation
  - directional derivatives
- integral calculus
  - revision-integration techniques (areas and volumes)
  - partial fractions
  - integration by parts
  - trigonometric and hyperbolic substitution methods
  - improper integrals
  - integration of partial derivatives
  - evaluation of arc lengths
  - evaluation of surface areas

- mean and RMS values
- approximate integration (the trapezoidal and Simpson's rules)
- evaluation of centre of mass
- evaluation of centroidal positions in plane regions
- evaluation of moments of inertia and second moments of area
- evaluation of work and energy
- evaluation of centres of pressure on submerged plates

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify appropriate calculus technique for engineering or related problems</li> <li>• apply the appropriate technique to the problem</li> <li>• check answer has addressed problem</li> <li>• communicate the outcome of the analysis in an appropriate way.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competency covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its</li> </ul>

	<p>correct interpretation and application.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Data available</b>	<p>Data currently available includes:</p> <ul style="list-style-type: none"> <li>• all relevant data which is currently available within the organisation or could be readily obtained</li> </ul>
<b>Information required</b>	Information required means the outcome which needs to be produced in order to solve/assist in resolving the defined problem
<b>Calculus</b>	<p>Calculus for this unit refers to:</p> <ul style="list-style-type: none"> <li>• problem solving using one or more or any of the techniques listed under 'required knowledge' or a related technique</li> </ul>
<b>Computational device</b>	<p>Computational devices include:</p> <ul style="list-style-type: none"> <li>• calculators with calculus functions</li> <li>• computer software packages</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action may include:</p> <ul style="list-style-type: none"> <li>• taking necessary steps to obtain required data</li> <li>• obtaining some relevant proxy for the desired data</li> <li>• choosing a different calculus/computational device which will function with available data</li> </ul>
<b>Appropriate technique</b>	<p>Appropriate technique includes:</p> <ul style="list-style-type: none"> <li>• selected calculus which will yield required outcome</li> </ul>

	<ul style="list-style-type: none"><li>• technique which is appropriate for the available data and which is relevant to the problem</li></ul>
<b>Check answer</b>	Checking answer means that the answer is examined to ensure it is within the range of expected logical results
<b>Interpret answer</b>	Interpret answer means translating the result of the calculus solution into a form which is useable by the relevant stakeholders
<b>Appropriate communication</b>	Appropriate communication may include: <ul style="list-style-type: none"><li>• report</li><li>• presentation</li><li>• verbal communication</li><li>• web-based</li><li>• electronic or hard copy</li></ul>
<b>Check outcome</b>	Check outcome includes: <ul style="list-style-type: none"><li>• ensuring that the result of the analysis does assist in the resolution of the problem</li></ul>

## Unit Sector(s)

Not applicable.

## Custom Content Section

Not applicable.

# **MEM234023A Apply differential equations to technology problems**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the application of differential equations in an engineering or related application. It includes first and second order differential equations (DE's) and covers both the application of theory in simple calculations and the use of relevant software packages for more complex situations.

## **Application of the Unit**

This unit applies to projects or tasks requiring solving DE's, either manually or through use of an appropriate software package. It is suitable for paraprofessionals and technologists required to solve advanced mathematical problems in an engineering or related field, or those pursuing technologist careers and qualifications.

Prior or concurrent experience in mathematics covering calculus and differentials is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of



performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Identify a need for the application of DE's | 1.1 | Identify a problem requiring application of DE's                         |
|   |   | 1.2 | Define the problem   |
|   |   | 1.3 | Determine data currently available for analysis                          |
|   |   | 1.4 | Identify ways of obtaining other required data                           |
|   |   | 1.5 | Determine information required from outcome                              |
| 2 | Prepare to solve problem by DE's            | 2.1 | Determine appropriate DE to be applied                                   |
|   |   | 2.2 | Identify and gain access to appropriate computational devices            |
|   |   | 2.3 | Collect required input data  |
|   |   | 2.4 | Analyse collected data for suitability and completeness                  |
|   |   | 2.5 | Take appropriate action to address any deficiencies found                |
| 3 | Solve problem using DE's                    | 3.1 | Apply appropriate technique to collected data                            |
|   |   | 3.2 | Check answer by appropriate means  |
|   |   | 3.3 | Interpret answer to determine information required by problem definition |
| 4 | Communicate outcomes                        | 4.1 | Communicate outcome to relevant stakeholders by appropriate means        |
|   |   | 4.2 | Explain outcome to stakeholders, as appropriate                          |
|   |   | 4.3 | Check outcome has addressed problem                                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and defining problems
- collecting and analysing data
- reporting and presenting data and quantitative information
- communicating effectively with stakeholders on problem resolution

### Required knowledge

Required knowledge includes:

- ordinary DE's
- first order separable DE's
- first order linear DE's
- first order exact DE's
- second order linear homogeneous DE's with constant coefficients
- second order linear non-homogeneous DE's with constant coefficients
- DE's
  - definition of a DE
  - first order DE's – separation of variables and applications
- second order DE's of the form:  $\frac{d^2 y}{dx^2} = f(x)$
- second order DE's of the form:  $\frac{d^2 y}{dx^2} = f(y)$
- first order DE's of the form:  $\frac{dy}{dx} + Py = Q$
- second order DE's of the form:  $a\frac{d^2 y}{dx^2} + b\frac{dy}{dx} + cy = 0$
- second order DE's of the form:  $a\frac{d^2 y}{dx^2} + b\frac{dy}{dx} + cy = f(x)$
- motion
- kinematics
- resisted gravitational motion
- simple harmonic motion
- vibratory motion

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify appropriate differential equations for engineering or related problems</li> <li>• apply the appropriate technique to the problem</li> <li>• check answer has addressed problem</li> <li>• communicate the outcome of the analysis in an appropriate way.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competency covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>

Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Problem definition</b>	Problem definition means the problem will be defined so as to allow for the use of differential equations and the application of quantitative data
<b>Data available</b>	Data currently available means all relevant data which is currently available within the organisation or could be readily obtained
<b>Information required</b>	Information required is the outcome which needs to be produced in order to solve/assist in resolving the defined problem
<b>Differential equations</b>	Differential equations may include: <ul style="list-style-type: none"> <li>• one or more or any of the techniques listed under 'required knowledge'</li> <li>• a related technique</li> </ul>
<b>Computational device</b>	Computational devices include: <ul style="list-style-type: none"> <li>• calculators with differential equations functions</li> <li>• computer software packages</li> </ul>
<b>Appropriate action</b>	Appropriate action may include: <ul style="list-style-type: none"> <li>• taking necessary steps to obtain required data</li> <li>• obtaining some relevant proxy for the desired data</li> <li>• choosing a different differential equation/computational device which will function with available data</li> </ul>
<b>Appropriate technique</b>	Appropriate technique includes: <ul style="list-style-type: none"> <li>• selected differential equation which will yield required outcome</li> <li>• a technique which is appropriate for the available data and which is relevant to the problem</li> </ul>
<b>Check answer</b>	Checking answer means that the answer is examined to ensure it is within the range of expected logical results

<b>Interpret answer</b>	Interpret answer means translating the result of the differential equation solution into a form which is useable by the relevant stakeholders
<b>Appropriate communication</b>	Appropriate communication may include: <ul style="list-style-type: none"><li>• report</li><li>• presentation</li><li>• verbal communication</li><li>• web-based</li><li>• electronic or hard copy</li></ul>
<b>Check outcome</b>	Check outcome includes: <ul style="list-style-type: none"><li>• ensuring that the result of the analysis does assist in the resolution of the problem</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234024A Apply advanced mathematics in technology problems**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the application of advanced mathematics in an engineering or related application. It includes a range of mathematical techniques and covers both the application of theory in simple calculations and the use of relevant software packages for more complex situations.

## **Application of the Unit**

This unit applies to projects or tasks requiring advanced mathematics, either manually or through use of an appropriate software package. It is suitable for paraprofessionals and technologists required to solve advanced mathematical problems in an engineering or related field, or those pursuing technologist careers and qualifications.

Prior or concurrent experience in mathematics is required.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify a need for the application of advanced mathematics	1.1	Identify a problem requiring application of mathematics
		1.2	Define the problem
		1.3	Determine data currently available for analysis
		1.4	Identify ways of obtaining other required data
		1.5	Determine information required from outcome
2	Prepare to solve problem by advanced mathematics	2.1	Determine appropriate mathematics to be applied
		2.2	Identify and gain access to appropriate computational devices
		2.3	Collect required input data
		2.4	Analyse collected data for suitability and completeness
		2.5	Take appropriate action to address any deficiencies found
3	Solve problem using advanced mathematics	3.1	Apply appropriate techniques to collected data
		3.2	Check answer by appropriate means
		3.3	Interpret answer to determine information required by problem definition
4	Communicate outcomes	4.1	Communicate outcome to relevant stakeholders by appropriate means
		4.2	Explain outcome to stakeholders as appropriate
		4.3	Check outcome has addressed problem

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and defining problems
- collecting and analysing data
- reporting and presenting data and quantitative information
- communicating effectively with stakeholders on problem resolution

### Required knowledge

Required knowledge includes:

- exponential, trigonometric and hyperbolic functions
  - revision - functionality and inverse functions
  - exponential and logarithmic functions;
  - trigonometric and inverse trigonometric functions
  - hyperbolic and inverse hyperbolic functions
- series:
  - revision of arithmetic and geometric progressions
  - limits
  - linear and quadratic approximations (Taylor polynomials)
  - partial sums
  - geometric series
  - power series
  - Maclaurin series
- vectors:
  - vectors in 3-dimensions
  - $i$   $j$   $k$  notation
  - magnitude (or modulus) of a vector
  - unit vectors and direction angles
  - scalar or 'dot' product of two vectors
  - vector or 'cross' product of two vectors
  - resolution of vectors
  - differentiation and integration of vectors
  - dynamics:
    - Newton's Laws of Motion
    - energy, work and power



- the work-energy theorem
  - moment of a force
- analytical geometry:
  - equation of a plane
  - the angle between two planes
  - the distance from a point to a plane
  - lines in 3-dimensional space
- graphing techniques:
  - coordinate geometry
  - graphs of exponential growth and decay
  - graphs with logarithmic scales
  - method of least squares
  - polar coordinates and polar graphs
  - graphs of functions of two variables
  - quadric surfaces
- complex numbers:
  - introduction to complex numbers:
    - Cartesian form
    - the Argand plane
    - trigonometric and polar form
    - subsets of the complex plane
    - De Moivre's Theorem
  - exponential form of complex numbers
  - applications to mesh current network analysis
- linear algebra:
  - matrix algebra:
    - basic operations
    - applications
    - transformations
  - determinants
  - systems of equations I:
    - solutions and inverses
    - applications
  - systems of equations II (numerical techniques)
  - systems of equations III (other systems)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify appropriate mathematical techniques for engineering or related problems</li> <li>• apply the appropriate technique to the problem</li> <li>• check answer has addressed problem</li> <li>• communicate the outcome of the analysis in an appropriate way.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competency covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Data available</b>	Data currently available includes: <ul style="list-style-type: none"> <li>all relevant data which is currently available within the organisation or could be readily obtained</li> </ul>
<b>Information required</b>	Information required is the outcome which needs to be produced in order to solve/assist in resolving the defined problem
<b>Mathematics</b>	Mathematics may include: <ul style="list-style-type: none"> <li>one or more or any of the techniques listed under 'required knowledge'</li> <li>a related technique</li> </ul>
<b>Computational device</b>	Computational devices include: <ul style="list-style-type: none"> <li>calculators with appropriate mathematical functions</li> <li>computer software packages</li> </ul>
<b>Appropriate action</b>	Appropriate action may include: <ul style="list-style-type: none"> <li>taking necessary steps to obtain required data</li> <li>obtaining some relevant proxy for the desired data</li> <li>choosing a different mathematical/computational device which will function with available data</li> </ul>
<b>Appropriate technique</b>	Appropriate technique includes: <ul style="list-style-type: none"> <li>selected mathematical technique which will yield required outcome</li> <li>a technique which is appropriate for the available data and which is relevant to the problem</li> </ul>
<b>Check answer</b>	Checking answer means examining the answer to ensure it is within the range of expected logical results
<b>Interpret answer</b>	Interpret answer means translating the result of the mathematical solution into a form which is useable by the relevant stakeholders
<b>Appropriate communication</b>	Appropriate communication may include: <ul style="list-style-type: none"> <li>report</li> <li>presentation</li> </ul>

	<ul style="list-style-type: none"><li>• verbal communication</li><li>• web-based</li><li>• electronic or hard copy</li></ul>
<b>Check outcome</b>	Check outcome includes: <ul style="list-style-type: none"><li>• ensuring that the result of the analysis does assist in the resolution of the problem</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234025A Apply numerical methods to technology problems

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the application of numerical methods in an engineering or related application. It includes numerical solutions, solutions to different equation types, and covers both the application of theory in simple calculations and the use of relevant software packages for more complex situations.

## Application of the Unit

This unit applies to projects or tasks requiring numerical solutions involving numerical solutions and the solution of different types of equations by numerical methods, either manually or through use of an appropriate software package. It is suitable for paraprofessionals and technologists required to solve advanced mathematical problems in an engineering or related field, or those pursuing technologist careers and qualifications and for articulation of qualifications into degree programs.

Prior or concurrent experience in mathematics covering polynomials and differential equations is required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Identify a need for the application of numerical methods | 1.1 | Identify a problem requiring application of numerical methods            |
|   |  | 1.2 | Define the problem   |
|   |  | 1.3 | Determine data currently available for analysis                          |
|   |  | 1.4 | Identify ways of obtaining other required data                           |
|   |  | 1.5 | Determine information required from outcome                              |
|   |  |     |  |
| 2 | Prepare to solve problem by numerical methods            | 2.1 | Determine numerical methods to be applied                                |
|   |  | 2.2 | Identify and gain access to appropriate computational devices            |
|   |  | 2.3 | Collect required input data  |
|   |  | 2.4 | Analyse collected data for suitability and completeness                  |
|   |  | 2.5 | Take appropriate action to address any deficiencies found                |
|   |  |     |  |
| 3 | Solve problem using numerical methods                    | 3.1 | Apply appropriate techniques to collected data                           |
|   |  | 3.2 | Check answer by appropriate means  |
|   |  | 3.3 | Interpret answer to determine information required by problem definition |
|   |  |     |  |
| 4 | Communicate outcomes                                     | 4.1 | Communicate outcome to relevant stakeholders by appropriate means        |
|   |  | 4.2 | Explain outcome to stakeholders, as appropriate                          |
|   |  | 4.3 | Check outcome has addressed problem                                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and defining problems
- collecting and analysing data
- reporting and presenting data and quantitative information
- communicating effectively with stakeholders on problem resolution

### Required knowledge

Required knowledge includes:

- numerical solutions:
  - finite difference techniques
  - polynomial interpolation
- errors:
  - computer arithmetic
  - propagation of errors
- solution of non-linear equations:
  - fixed point and bisection method
  - Secant and Newton-Raphson iterative methods
  - convergence
- solution of systems of linear equations:
  - Gaussian elimination
  - pivoting strategies
  - LU factorisation
  - Ill-conditioning
  - errors and residuals
  - iterative methods
- solution of differential equations:
  - Euler method
  - Taylor and Runge-Kutta methods
  - convergence
- Interpolation and Approximation:

- polynomial interpolation
- Lagrange form
- Newton's divide formula
- error bound
- finite difference techniques:
  - solution of problems in electrostatics and wave propagation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify appropriate numerical methods for engineering or related problems</li> <li>• apply the appropriate technique to the problem</li> <li>• communicate the outcome of the analysis in an appropriate way.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competency covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real</li> </ul>



	<p>or simulated) and require evidence of process.</p> <ul style="list-style-type: none"> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Data available</b>	<p>Data currently available includes:</p> <ul style="list-style-type: none"> <li>all relevant data which is currently available within the organisation or could be readily obtained</li> </ul>
<b>Information required</b>	Information required is the outcome which needs to be produced in order to solve/assist in resolving the defined problem
<b>Numerical methods</b>	<p>Numerical methods may include:</p> <ul style="list-style-type: none"> <li>one or more or any of the techniques listed under 'required knowledge'</li> <li>a related technique</li> </ul>
<b>Computational device</b>	<p>Computational devices include:</p> <ul style="list-style-type: none"> <li>calculators with numerical methods functions</li> <li>computer software packages</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action may include:</p> <ul style="list-style-type: none"> <li>taking necessary steps to obtain required data</li> <li>obtaining some relevant proxy for the desired data</li> <li>choosing a different numerical method/computational device which will function with available data</li> </ul>
<b>Appropriate technique</b>	<p>Appropriate technique includes:</p> <ul style="list-style-type: none"> <li>selected numerical method which will yield required outcome</li> <li>technique which is appropriate for the available data and which is</li> </ul>

	relevant to the problem
<b>Check answer</b>	Checking answer means examining the answer to ensure it is within the range of expected logical results
<b>Interpret answer</b>	Interpret answer means translating the result of the numerical analysis into a form which is useable by the relevant stakeholders
<b>Appropriate communication</b>	Appropriate communication may include: <ul style="list-style-type: none"><li>• report</li><li>• presentation</li><li>• verbal communication</li><li>• web-based</li><li>• electronic or hard copy</li></ul>
<b>Check outcome</b>	Check outcome includes: <ul style="list-style-type: none"><li>• ensuring that the result of the analysis does assist in the resolution of the problem</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## **MEM234026A Develop and coordinate engineering-related contingency plans**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the skills required to develop and coordinate contingency plans for engineering projects or operations that provide for recovery from a major incident or non-conformance.

### **Application of the Unit**

This unit applies to contingency planning for engineering-related projects or operations across all forms of manufacturing and engineering. Activities covered include systematic analysis of the engineering activity to identify major contingencies, developing appropriate responses and coordinating the implementation of contingency plans into operations. It embraces personal and electronic communication, self-directed and group activities, business planning, employee briefing and training, project or operations planning and scheduling, and an understanding of the technology, skills, techniques and quality requirements of the project or operations.

This unit does not cover the planning required to contain/remediate an emergency non-conformance, such as a fire or explosion. Relevant emergency management skills from other Training Packages should be accessed for these skills.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Establish contingency plan task	1.1	Review existing technologies, processes, standards and procedures
		1.2	Clarify contingency plan objectives and scope with client
		1.3	Prepare task schedules and requirements for development of contingency plans
		1.4	Establish contingency planning team, if required, and assign responsibilities within the team
2	Conduct impact assessment	2.1	Prepare comprehensive list of potential incidents
		2.2	Rate each potential incident for impact severity level
		2.3	Identify which incidents will be included in plan
3	Develop contingency plan	3.1	Formulate an action plan to deal with each significant risk
		3.2	Ensure occupational health and safety (OHS) requirements, codes of practice, regulations, standards and other regulatory requirements and enterprise procedures are included
		3.3	Determine resources required to support plans
		3.4	Assign responsibility for each planned action
		3.5	Determine costs associated in planned responses
		3.6	Determine trigger points for planned responses
		3.7	Review plan proposals and costs with client and stakeholders to obtain sign-off, and adjust plan, as

required

- |   |                                 |     |  |
|---|---------------------------------|-----|--|
| 4 | Implement and maintain the plan | 4.1 | Finalise planning, including ensuring preparation of all required documentation, drawings, specifications and instructions |
|   |                                 | 4.2 | Communicate the plan with all personnel who have a role in implementing the contingency plan                               |
|   |                                 | 4.3 | Generate standard procedures to ensure plan is maintained and updated following any change in the project or operations    |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- assessing engineering-related technologies and operations for contingency risks and significance, including relevant engineering, production and financial calculations and analysis
- evaluating solutions for feasibility against engineering design or specification criteria, including relevant engineering calculations and analysis
- performing responsibilities in priority order
- using and validating performance analysis, modelling and simulation software for contingency-related analyses
- delegating roles, responsibilities and levels of authority, as appropriate, to team members
- communicating, negotiating and reviewing with stakeholders and team members throughout project and operation duration

### Required knowledge

Required knowledge includes:

- context of operations or project, such as competitive pressures or markets, customer-supplier relationships, regulatory and industrial environment, resourcing and labour issues
- engineering-related modelling and simulation software, including underpinning program and software validation techniques
- budget and control measures for project or operations management from the financial

business plan

- physical resources for project or operations
- human resources and skills development techniques and requirements for engineering-related projects
- recording and implementation requirements for engineering projects or operations, such as, schedules, budgets, personnel and resource allocations, and standard operating procedures, including maintenance procedures
- tendering and contracts requirements and processes, including agreement on engineering design and technical specification, negotiations and optimisations, provisions for variations, delays and penalties
- requirements for, and functions of, technical documentation, graphics and specifications and records of meetings, communications, negotiations, decisions and agreements with stakeholders
- systems thinking, contingency and constraints management
- typical management accounting processes which may relate to an engineering project or operation, such as:
  - cash flow and liquidity
  - assets and liabilities
  - costing and break-even analysis
  - financial record keeping procedures for expenditures
- typical legal requirements for engineering-related projects or operations
- OHS requirements, codes of practice, regulations, standards, regulatory requirements for project or operations, current safe work methods statements, material safety data sheets (MSDS) and work permits
- work organisation and management theory
- conflict resolution, problem solving and decision making

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify and establish risks and consequences for the project or operation</li> <li>• establish resources required, including labour, materials, and equipment within budgets and procedures</li> <li>• establish support team and responsibilities</li> <li>• overcome constraints to achievement of schedules and</li> </ul>
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	<p>budgets as contained in contingency plan</p> <ul style="list-style-type: none"> <li>• undertake appropriate internal and external reporting</li> <li>• manage continuous improvement.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, or a combination of both on and off the job assessment based on appropriate project and simulation activities. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>A major incident or non-conformance</b>	<p>A major incident or non-conformance may include:</p> <ul style="list-style-type: none"> <li>• power, fuel energy failure or shortage</li> <li>• breakdown of critical plant or equipment</li> <li>• loss of key personnel</li> <li>• material supply shortages</li> <li>• safety issues</li> <li>• product liability issues</li> <li>• substantial material price increase</li> </ul>
<b>Action plans</b>	<p>Action plans may include the use of:</p> <ul style="list-style-type: none"> <li>• substitute materials and components</li> <li>• alternate processing</li> <li>• alternate approved supply sources</li> <li>• rationing of materials in short supply</li> <li>• external sources of labour</li> <li>• expert technical sources</li> </ul>
<b>OHS requirements, codes of practice, regulations, standards and other regulatory requirements and enterprise procedures</b>	<p><b>OHS requirements, codes of practice, regulations, standards and other regulatory requirements and enterprise procedures</b> may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Appropriate modelling and analysis software</b>	<p>Appropriate modelling and analysis software may include:</p> <ul style="list-style-type: none"> <li>• project tracking</li> <li>• financial modelling, analysis and tracking</li> <li>• process modelling and analysis</li> <li>• engineering simulation and modelling</li> <li>• manufacturing operation simulation</li> </ul>
<b>Existing technologies, processes, standards and</b>	<p><b>Existing technologies, processes, standards and procedures</b> may include:</p>



<b>procedures</b>	<ul style="list-style-type: none"><li>• standard operating procedures, including maintenance procedures</li><li>• records of operations, including tenders, contracts, schedules, personnel, resource allocations and financial management procedures</li><li>• documentation and records of current safe work methods statements, MSDS, work permits, standards and codes of practice</li></ul>
<b>Legislative requirements</b>	Legislative requirements may include: <ul style="list-style-type: none"><li>• industrial law and awards</li><li>• customer protection law</li><li>• restrictive trade practice</li><li>• environmental protection</li><li>• workers compensation</li><li>• equal opportunity and anti-discrimination</li></ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234027A Plan and manage materials supply for an engineering project or manufacturing operation**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the engineering skills and knowledge required to plan and manage all aspects of the supply of materials to an engineering project or operation. It includes managing supplier identification and negotiations, purchasing and scheduling, including the interpretation of client, design, marketing, sales and production requirements to enable matching to available resources, budgets, workforce and contractors. It also includes the control of processes, physical resources, workforce skills and resources to enable the use of assets within budget requirements.

## **Application of the Unit**

This unit applies to people who require significant engineering skills and knowledge to plan and manage supply, scheduling and purchasing of materials across all forms of manufacturing and engineering. Typical applications would be where there are:

- many material inputs, major assembly lines or manufacturing cells, such as whitegoods and vehicle manufacturing
- heavy and light fabrication involving significant use of material
- requirements to either determine, select or interpret technical specifications and standards for purchasing, scheduling and production planning.

The unit can provide technical support training where the planning, scheduling and purchasing is done in an engineering or manufacturing organisation following lean principles. In this situation it is recommended that the unit be co-delivered with appropriate Manufacturing Skills Australia (MSA) Competitive Manufacturing units of competency.

Prior or concurrently developed capability in personal and electronic communication, self-directed and group activities, planning and scheduling, performance analysis, process control and improvement, and an understanding of technology, skills and techniques, and quality aspects required by operations is required.

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify and verify production or fabrication requirements	1.1	Identify parameters, context and objectives of manufacturing or project operations
		1.2	Verify key internal and external stakeholders, labour and skills distribution, functional team relationships, information flow requirements, communications and reporting lines, and procedures are appropriate to manufacturing or project operational objectives
		1.3	Review operations planning and management and confirm compatible scheduling, purchasing and production control measures
		1.4	Confirm reporting and technical support arrangements
		1.5	Verify facilities, services, plant, tooling and software, process layout and use of automation are appropriate to product manufacturability
		1.6	Identify and confirm that compliance requirements of occupational health and safety (OHS) and regulations, codes of practice, standards, risk assessment and registration requirements for manufacturing plant are observed

- |   |                                 |   |
|---|---------------------------------|---|
| 2 | Develop the production plan     | <ul style="list-style-type: none"><li>2.1 Participate in development of demand forecast</li><li>2.2 Prepare production or project plan in consultation with relevant stakeholders to meet quality, demand and delivery timelines within capacity and budget constraints</li><li>2.3 Manage preparation of purchasing schedules</li><li>2.4 Manage or assist in preparation of production schedules</li><li>2.5 Develop contingency arrangements</li><li>2.6 Review final proposals with relevant stakeholders</li><li>2.7 Develop key performance indicators for materials supply</li></ul>   |
| 3 | Implement the production plan   | <ul style="list-style-type: none"><li>3.1 Delegate responsibilities for purchasing and detailed scheduling, including communication of priorities and key performance indicators</li><li>3.2 Manage materials and product flow and transfer operations, buffer and emergency stocks, warehousing, stores and logistics</li><li>3.3 Coordinate quality and process control procedures</li><li>3.4 Coordinate and monitor physical, human and financial resources and budget to achieve production plan</li><li>3.5 Communicate and maintain information and reporting procedures, and participate, cooperate and negotiate with relevant stakeholders</li><li>3.6 Coordinate continuous improvement, problem solving and decision making, address systems constraints and contingencies, adjust short-term planning and reschedule, as necessary</li></ul> |
| 4 | Monitor operational performance | <ul style="list-style-type: none"><li>4.1 Review actual materials supply against key performance indicators</li><li>4.2 Contribute to review of manufacturing operations against production plan and other key performance indicators</li><li>4.3 Participate in continuous improvement procedures,</li></ul>   |

including lean operation principles and procedures, where implemented

- 4.4 Review options and implementation of software options, such as enterprise resource planning (ERP), system control and data acquisition (SCADA) and spreadsheets
- 4.5 Contribute to risk management procedures and system maintenance in accordance with organisational procedures
- 4.6 Report progress against production plan in accordance with procedures
- 4.7 Provide documentation, data entry and analysis, as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- accurately taking large numbers of complex factors into account when planning materials supply
- managing and integrating information from a wide variety of sources
- managing supplier contracts and arrangements to meet the needs of the engineering and manufacturing operations
- developing continuous improvement, problem solving and decision making, constraint and contingency strategies, including short-term planning and rescheduling arrangements
- communicating and maintaining information consistent with reporting procedures
- participating, cooperating and negotiating with relevant stakeholders
- monitoring operations for compliance with organisational policies and procedures, OHS and regulatory requirements, product and process sustainability
- contributing to risk management procedures and system maintenance in accordance with organisational procedures
- reporting and documenting in accordance with procedures
- maintaining records of professional, trades and industry contacts, sources of information and resources

### Required knowledge

Required knowledge includes:

- sources of information and resources relating to materials supply
- personal and team skills and professional development requirements and options for addressing them
- operations management structures, labour and skills distribution, functional team relationships, and communications and reporting lines
- manufacturing management systems and philosophies relevant to planning and managing materials supply
- facilities, plant and services requirements
- OHS requirements, codes of practice, regulations, standards, regulatory requirements, risk management, current safe work methods statements, material safety data sheets (MSDS) and work permits
- financial requirements relevant to materials supply
- engineering approaches and processes underpinning project or manufacture
- labour and skills distribution
- formal procedures and informal communications and information flow
- automation and control technologies relevant to materials supply
- software options for tracking and managing of materials supply chain
- principles of value chain management, current and future state mapping
- requirements for, and functions of, technical and business documentation that may impact on the sustainability of operations

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• coordinate delegated responsibilities for manufacturing operations to the supplying, scheduling and purchasing of priority materials consistent with priorities and product flow</li><li>• coordinate transfer operations, buffer and emergency stocks</li><li>• implement constraint and contingency strategies</li><li>• monitor operations for compliance with organisational policies and procedures, product and process sustainability</li><li>• communicate, cooperate and negotiate with relevant stakeholders</li><li>• manage reporting against key performance indicators and organisation requirements.</li></ul>
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Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Production</b>	<p>Production in this unit refers to operations requiring major engineering input and significant coordination of suppliers, purchasing and scheduling including:</p> <ul style="list-style-type: none"> <li>• volume production of components or full items (e.g. whitegoods, vehicles, transformers and transport equipment)</li> <li>• jobbing production</li> <li>• on-site fabrication of engineering-related items</li> </ul>
<b>Identify parameters, context and objectives of operations</b>	<p>Parameters, context and objectives to be taken into account may include:</p> <ul style="list-style-type: none"> <li>• customer requirements</li> <li>• stock levels</li> <li>• production capacity and availability</li> <li>• labour requirements and availability</li> <li>• supplier capacity</li> <li>• warehousing, stores and logistics</li> </ul>
<b>Relevant stakeholders</b>	<p>Relevant stakeholders may include:</p> <ul style="list-style-type: none"> <li>• team</li> <li>• organisation functional groups</li> <li>• supervisors with approval delegation</li> <li>• customers and suppliers</li> </ul>
<b>OHS, regulatory requirements and enterprise procedures</b>	<p>OHS, regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Legal obligations of businesses</b>	<p>Businesses have legal obligations under:</p> <ul style="list-style-type: none"> <li>• contract law</li> <li>• commercial law</li> <li>• company law</li> <li>• fair trading act has customer protection and restrictive trade provisions</li> <li>• environmental planning and assessment act</li> <li>• Commonwealth and state/territory tax laws</li> <li>• industrial law which deals with employee and employer relationships, awards and agreements, trade unions, and their powers and rights</li> <li>• OHS Act and regulations</li> </ul>



<b>Records of operations</b>	<p>Records of operations may include:</p> <ul style="list-style-type: none"> <li>• tenders, contracts and schedules</li> <li>• personnel, resource allocations and financial management procedures</li> <li>• standard operating procedures, including maintenance procedures</li> <li>• OHS committee minutes and actions, risk management and mitigation</li> <li>• documentation and records of current safe work methods statements, MSDS and work permits</li> <li>• standards, codes of practice, audits and meetings</li> <li>• communications, graphics and specifications</li> </ul>
<b>Continuous improvement implementation</b>	<p>Continuous improvement implementation may relate to plant, products, processes, systems or services, including design, development, implementation or manufacture, commissioning, operation or delivery and maintenance. Improvement processes may include techniques, such as:</p> <ul style="list-style-type: none"> <li>• balanced scorecard</li> <li>• current and future state mapping</li> <li>• measuring performance against benchmarks</li> <li>• process improvement, problem solving and decision making</li> <li>• data management, generation, recording, analysing, storing and use of software</li> <li>• training for improvement systems participation</li> <li>• technical training</li> </ul>
<b>Constraints and contingencies</b>	<p>Contingencies arising during operations or improvement projects will have constraints on possible solutions. These may be:</p> <ul style="list-style-type: none"> <li>• financial</li> <li>• organisation procedural or culture</li> <li>• physical constraints such as limits to resources, limits to site access or logistical limitations</li> </ul>
<b>Systems thinking</b>	<p>Systems thinking:</p> <ul style="list-style-type: none"> <li>• is the process of developing solutions within the context of an entire system</li> <li>• recognises that an improvement in one subsystem can adversely affect another subsystem</li> </ul>
<b>Lean manufacturing</b>	<p>Lean manufacturing uses cost, capacity and responsiveness, quality, reliability and waste minimisation as drivers of the process and measures for process improvement. Lean manufacturing is the response of many organisations to local, regional, national and global market competitiveness</p>

<b>Software options and the need for validation</b>	<p>Software may be employed for planning, scheduling, and performance analysis/modelling and may include:</p> <ul style="list-style-type: none"><li>• enterprise resources planning (ERP), system control and data acquisition (SCADA) and spreadsheets. Underpinning program techniques and algorithms should be understood</li></ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"><li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li><li>• review of previously implemented design challenges which were completed using the software</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# MEM234028A Produce and manage technical documentation

## Modification History

New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to develop and produce engineering-related technical documentation and to manage documentation distribution and use within an organisation.

## Application of the Unit

This unit applies where engineering skills and knowledge are required for the production and management of technical documentation for use within an organisation and by other users, such as contractors and dealers. Technical documentation may include production control records, work instructions and standard operating procedures, process specifications, occupational health and safety (OHS) procedures, quality procedures, contractor instructions, and documentation required to comply with legislative and regulatory requirements.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Develop technical documentation                  | 1.1 | Evaluate the requirement for technical documentation, including purpose, scope and intended audience   |
|   |  | 1.2 | Consult original sources of engineering and other technical data   |
|   |  | 1.3 | Determine the required layout, style, content and resources required for production of documentation   |
|   |  | 1.4 | Draft technical documentation and verify for accuracy against standards and other original sources   |
|   |  | 1.5 | Develop review and version control procedures  |
|   |  | 1.6 | Submit technical documentation, version control and review procedures for approval   |
|   |  | 1.7 | Develop and apply a technical documentation archiving system that complies with organisational policy and applicable legislative and regulatory requirements |
| 2 | Produce and distribute technical documentation   | 2.1 | Produce technical documentation and apply version and distribution controls  |
|   |  | 2.2 | Distribute technical documentation   |
| 3 | Monitor usage and revise technical documentation | 3.1 | Monitor the usage of technical documentation   |
|   |  | 3.2 | Revise and improve technical documentation, when necessary   |
|   |  | 3.3 | Apply version and distribution controls to revised technical documentation   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying the requirement for technical documentation
- determining original sources for researching and verifying engineering-related technical content
- determining the style and layout of technical documentation
- analysing, designing, planning, executing and verifying content requirements against engineering and other technical data from original sources
- determining procedures for review and amendment
- developing and applying version control procedures
- effectively controlling technical documentation distribution and archiving of completed documentation
- using oral and written communication to convey broad and specialised information in a variety of media and formats

## Required knowledge

Required knowledge includes:

- word processing, spreadsheet and database software to produce technical documentation
- typical sources for researching engineering and technical data for applications and discipline area
- types of technical documentation
- layouts for technical documentation
- version and distribution control systems
- archiving systems
- legislative and regulatory requirements associated with technical documentation that are relevant to the organisation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• identify and establish engineering and organisation goals and requirements for the project or operation that may bear on the production of technical documentation</li><li>• establish resources required for the research, production, distribution and ongoing maintenance of technical</li></ul>
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	<p>documentation, including labour, materials, and equipment within budgets and procedures</p> <ul style="list-style-type: none"> <li>• identify and consult original sources of engineering and technical data</li> <li>• produce technical documentation and verify for technical accuracy and suitability for application</li> <li>• distribute technical documentation to users</li> <li>• arrange for handling of enquires, updates and version control.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, or a combination of both on and off the job assessment based on appropriate project and simulation activities. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. Where simulation is used for this unit, it is important that the simulation includes appropriate testing of the suitability of the produced documentation for user groups. For example, production of standard operating procedures should include testing of the standard operating procedures for ease of use by operators or other target groups and accuracy of description of the process or equipment covered by the standard operating procedures.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning engineering knowledge to technical documentation production.</li> <li>• Assessment methods should include questioning or other assessment method on sources and extent of engineering knowledge to ensure ability interpret, apply and verify</li> </ul>

	<p>engineering content for documents.</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

The requirement for technical documentation	<p><b>The requirement for technical documentation may arise from:</b></p> <ul style="list-style-type: none"> <li>• organisational policy</li> <li>• standard procedures</li> <li>• quality procedures</li> <li>• production and process control requirements</li> <li>• the need to specify procedures and requirements for contractors</li> <li>• the need to comply with legislative requirements and associated regulations</li> </ul>
Types of technical documentation	<p><b>Types of technical documentation may include:</b></p> <ul style="list-style-type: none"> <li>• production and process control records</li> <li>• process specifications</li> <li>• work instructions, standard operating procedures and checklists</li> <li>• certification documents</li> <li>• OHS procedures</li> <li>• quality procedures</li> </ul>

	<ul style="list-style-type: none"> <li>• contractor instructions</li> <li>• processes or records for compliance with legislation and/or regulations</li> <li>• tender/contract deliverable requirements</li> </ul>
Original sources	<p>Original sources provide the engineering and other technical information used to inform and verify the technical documentation being produced. The sources may include:</p> <ul style="list-style-type: none"> <li>• standards, codes, Acts and regulations</li> <li>• manufacturer's instructions and manuals</li> <li>• engineering-related textbooks and journals</li> <li>• professional engineers, scientists and other technical experts</li> <li>• technical drawings and other design information</li> <li>• customer brief</li> <li>• production records and schedules</li> </ul>
Version control	<p>Version control:</p> <ul style="list-style-type: none"> <li>• is required whenever technical documentation may be subject to revision</li> <li>• may take the form of either a date or issue number (or both) inserted in the document header or footer</li> <li>• should include a formal recording process that could take the form of a version control database</li> </ul>
Distribution control	<p>Distribution control may consist of:</p> <ul style="list-style-type: none"> <li>• a listing of recipients of each type of document and, where required, a document tracking system</li> </ul>
Archiving of technical documentation	<p>Archiving of technical documentation:</p> <ul style="list-style-type: none"> <li>• may be required to comply with legislative or regulatory requirements, and/or with organisational policy</li> <li>• should include an indexing system that specifies the period for which the document is to be retained</li> <li>• should comply with relevant requirements regarding physical storage and security</li> </ul>
Regulatory requirements, and organisational policies and procedures	<p>Regulatory requirements, and organisational policies and procedures may be found in:</p> <ul style="list-style-type: none"> <li>• organisational policy manuals</li> <li>• procedures manuals</li> <li>• quality manuals</li> <li>• Commonwealth and state/territory OHS legislation</li> <li>• industrial law and awards</li> <li>• customer protection law</li> </ul>



	<ul style="list-style-type: none"><li>• environmental protection</li><li>• workers compensation</li><li>• contract law</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234029A Produce and manage technical publications**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop and produce engineering-related technical publications and to manage publications within the organisation.

## **Application of the Unit**

This unit applies where engineering skills and knowledge are required for the production and management of technical publications for use within the organisation and by downstream users, such as contractors and final customers.

Applications include workshop manuals, operating instructions, parts catalogues, procedures manuals and related technical publications.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |      |   |
|---|--|------|---|
| 1 | Develop technical publications                 | 1.1  | Identify the requirement for technical publications   |
|   |  | 1.2  | Determine the required medium, style and layout   |
|   |  | 1.3  | Obtain or access relevant data  |
|   |  | 1.4  | Identify potential problems and consult relevant experts involved in product engineering design and/or production |
|   |  | 1.5  | Determine resolution strategies   |
|   |  | 1.6  | Draft the publication using relevant guidelines and specified or selected software package                        |
|   |  | 1.7  | Select required graphics and raise illustrator briefs   |
|   |  | 1.8  | Observe copyright legislation   |
|   |  | 1.9  | Insert completed graphics into the draft and add annotations/labels   |
|   |  | 1.10 | Prepare the draft for publishing and submit for editorial review  |
| 2 | Produce and distribute technical publications  | 2.1  | Submit proof copy of the publication or publication amendment for client acceptance                               |
|   |  | 2.2  | Arrange publication   |
|   |  | 2.3  | Update distribution records, as required, and arrange delivery or distribution of the completed publication       |
| 3 | Manage the amendment of technical publications | 3.1  | Identify the need for publication amendment action  |
|   |  | 3.2  | Initiate amendment action   |
|   |  | 3.3  | Produce or edit draft amendments  |
|   |  | 3.4  | Arrange production and distribution of amendments   |
| 4 | Manage the                                     | 4.1  | Establish a publication distribution and amendment  |

distribution and control of technical publications		control system
	4.2	Manage publications in accordance with regulatory requirements, and organisational policies and procedures
	4.3	Monitor the operation of the publication distribution and control system

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- researching engineering design, production and issues, such as end use, environment and related technical maintenance and product support policies
- using oral and written communication to convey broad and specialised information in a variety of media and formats
- analysing, designing, planning and implementing amendment generation, approval, recording and distribution procedures
- solving problems
- selecting and using word processing software and graphics packages
- specifying the style and layout of technical publications
- controlling procedures for technical publication distribution

### Required knowledge

Required knowledge includes:

- word processing and graphics packages used for technical publication and publication amendment drafting
- publication writing conventions, standards and specifications
- the use of style guides
- illustration techniques
- reading of engineering drawings, including:
  - standard drawing sheets and drawing layouts
  - types of drawing
  - engineering standards and specifications
  - technical terms and abbreviations
  - sectioned views

- dimensioning
- tolerancing of dimensions
- types of fit
- standard hardware
- screw threads
- threaded components and washers
- locking devices
- rivets
- special structural fasteners
- spur gears
- welding symbols and geometry tolerancing
- surface texture
- material specifications and metal surface treatment
- reading of electrical and electronic circuits and wiring diagrams
- development of system schematics
- development of block diagrams
- sketching
- use and development of logic charts
- development of fault diagnosis guides
- the preparation of illustrators' briefs
- the preparation of indexes to publication contents
- problem solving methodology
- regulations relevant to technical publications
- OHS legislation
- for print-based publications, procedures for processing drafts through desktop publishing to printing, binding and distribution
- for electronic format publications, the principles for publication database systems and the development of input data
- requirements for, and methods of, maintaining publication records
- applicable publication standards and systems
- copyright legislation
- desktop publishing software systems
- printing methods
- binder systems
- management methods for amendment, custody and distribution of technical publications
- version control procedures which will normally consist of a recording system for amendment distribution and incorporation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• identify requirements for drafting and amendment of technical publications</li> <li>• conduct research and gather required data from engineering records and relevant engineering staff and managers</li> <li>• select appropriate publication media and publication style and format</li> <li>• use selected software packages to draft technical publications</li> <li>• prepare illustrator briefings and observe copyright legislation</li> <li>• prepare proof copies of publications and obtain client approval</li> <li>• manage the production and devise distribution, amendment and version control systems.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, or a combination of both on and off the job assessment based on appropriate project and simulation activities. . Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of</li> </ul>

	<p>workplace relevant contexts) together with application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Technical publications</b>	<p>Technical publications may include:</p> <ul style="list-style-type: none"> <li>• workshop manuals</li> <li>• operating instructions</li> <li>• assembly instructions</li> <li>• parts catalogues</li> <li>• technical specifications</li> <li>• technical brochures for sales/marketing</li> <li>• procedures manuals</li> </ul>
<b>The required medium</b>	<p>The required medium may be:</p> <ul style="list-style-type: none"> <li>• print-based</li> <li>• electronic</li> <li>• microfiche</li> </ul>
• <b>Style and layout</b>	Style and layout may be determined from:

	<ul style="list-style-type: none"> <li>• an applicable style guide</li> <li>• contract requirements</li> <li>• industry standards and specifications</li> </ul>
<b>Relevant data sources</b>	<p>Relevant data sources may include:</p> <ul style="list-style-type: none"> <li>• design and production data and drawings</li> <li>• parts and materials listings</li> <li>• engineering specifications</li> <li>• operating procedure documentation</li> <li>• component assembly procedures</li> <li>• maintenance schedules</li> <li>• manufacturer and trade catalogues</li> <li>• relevant legislation and regulations</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Relevant experts</b></li> </ul>	<p>Relevant experts may include:</p> <ul style="list-style-type: none"> <li>• the client</li> <li>• design engineers and staff</li> <li>• production staff</li> <li>• maintenance managers and staff</li> <li>• component and material suppliers</li> <li>• regulator representatives</li> </ul>
<ul style="list-style-type: none"> <li>• <b>The requirement for publication amendment action</b></li> </ul>	<p>The requirement for publication amendment action may arise from:</p> <ul style="list-style-type: none"> <li>• publication user feedback</li> <li>• modifications to systems or components</li> <li>• test procedure development or refinement</li> <li>• quality system audits</li> <li>• compliance with regulatory requirements</li> </ul>
<b>The editing process</b>	<p>The editing process may involve checking for:</p> <ul style="list-style-type: none"> <li>• compliance with the style guide</li> <li>• completeness and ease of understanding</li> <li>• appropriate use of graphics</li> <li>• observance of applicable regulations and legislation including copyright</li> <li>• final draft mark-up for desktop publishing</li> <li>• application of version control procedures</li> </ul>
<b>Regulatory requirements, and organisational policies and procedures</b>	<p>Regulatory requirements, and organisational policies and procedures may be found in:</p> <ul style="list-style-type: none"> <li>• organisational policy manuals</li> <li>• procedures manuals</li> <li>• quality manuals</li> </ul>



	<ul style="list-style-type: none"><li>• Commonwealth and state/territory legislation and regulations in areas, such as OHS and environmental protection</li><li>• sustainability requirements</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

## **MEM234030A Provide specialised technical and engineering guidance to other technical employees**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the provision of technical advice, including mentoring to other technical and paraprofessional employees, usually but not always, working in the same technical field or discipline.

### **Application of the Unit**

This unit applies across all forms of manufacturing and engineering where an individual is using their professional skills and knowledge to provide engineering and technical guidance to other technical employees within the organisation. Examples of technical guidance situations include acting as a technical resource person to other technical employees or teams, or mentoring of other technical employees because of specialised skill and knowledge.

The emphasis in this unit is on the provision of technical advice usually as part of day-to-day operations where the person is not in a formally designated managerial or leadership role. The unit assumes technical competence to Advanced Diploma of Engineering level or equivalent industrial experience.

Where formal leadership and management of engineering and related projects or operations applies see the unit MEM234001A Plan and manage engineering-related projects or operations or other subject specific engineering leadership units, such as:

- MEM234031A Manage installation, commissioning or modification of machines and equipment
- MEM234032A Manage fluid power related technologies in an enterprise
- MEM234033A Lead engineering-related quality operations in an enterprise.

This unit does not cover the giving of general advice associated with conditions of employment, such as career planning and wages.

### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Respond to requests for technical advice or assistance	1.1	Confirm that request for assistance is of an engineering nature, including engineering-related outcomes required
		1.2	Identify extent of engineering information currently known
		1.3	Define issue or problem in engineering-related terms
		1.4	Identify whether request is within own discipline and skills and knowledge or should be referred to other expert technical or professional assistance
		1.5	Assist individuals or technical team to identify stakeholders to engineering issues and practice in the organisation
		1.6	Assist individuals or team to identify constraints and solution steps
		1.7	Verify solution
2	Identify other situations where current practice may be inadequate	2.1	Identify technical, engineering or sustainability-related risk factors in workplace
		2.2	Identifies risks associated with professional and ethical practice, occupational health and safety (OHS) and other

within the department or team		statutory responsibilities and liabilities
	2.3	Identify risk situations without adequate preventative and contingency planning
	2.4	Identify technical individuals or teams responsible for management of risks without adequate preventative and contingency planning
	2.5	Offer assistance and advice to resolve inadequacy

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying a range of information sources to develop and strengthen present engineering knowledge of other technical employees
- proposing options to achieve engineering solutions within discipline area
- proposing means of testing, measuring and evaluating solutions that fit with organisation objectives and accepted engineering practice
- providing advice on engineering-related costs and risks
- encouraging learning and professional practice in other engineering and technical employees, including adherence to legislative and regulatory requirements and ethical, OHS and quality standards
- assisting individuals and teams in setting performance targets for engineering-related activities
- advising on budgeting and financial management of engineering activities

### Required knowledge

Required knowledge includes:

- the principles of engineering as applied by designers in own area of expertise
- normal planning and scheduling approaches to engineering operations and tasks
- relationship of levels of practice in own engineering discipline, including situations where professional engineering, engineering technologist and engineering associate assistance or decision making is appropriate
- the situations where mathematics, including statistics, calculus or other advanced mathematics, must be used by to generate solutions to engineering problems, as well as situations where professional or other expert assistance should be accessed

- the structure, roles and capabilities of the engineering workforce in the organisation
- the interactions between engineering technologies and business operations, including impact of engineering on meeting client, employee, shareholder, regulatory and community expectations of the organisation
- regulatory and OHS responsibilities of technical and engineering workforce of the organisation
- administrative, human resources (HR) and other support services available to technical and engineering staff in the organisation

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• identify engineering-related situations that require referral to other experts</li><li>• identify and establish any risks or consequences for advice offered</li><li>• offer advice that takes into account the engineering operations and procedures of the organisation, the discipline area, and accepted engineering ethical practice</li><li>• identify situations where modelling, calculations or other investigations should occur before advice is offered</li><li>• understand and apply verification procedures to a range of engineering solutions in own area of expertise.</li></ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics</li></ul>

	<p>and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must include assessment of underpinning knowledge to ensure correct interpretation of guidance required and provision of appropriate advice.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Expert technical and professional assistance</b>	<p>Areas where expert technical and professional assistance may be sought include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as:</li> <li>high pressure</li> </ul>
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	<ul style="list-style-type: none"> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring or devices with high current or voltages above extra low voltage</li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> <li>professional advice on issues that may overlap with: <ul style="list-style-type: none"> <li>finance, accounts and tax</li> <li>insurance and legal</li> <li>training and HR</li> </ul> </li> </ul>
<b>OHS requirements, codes of practice, regulations, standards and other regulatory requirements and enterprise procedures</b>	<p>OHS requirements, codes of practice, regulations, standards and other regulatory requirements and enterprise procedures may include:</p> <ul style="list-style-type: none"> <li>OHS Acts and regulations</li> <li>relevant standards</li> <li>industry codes of practice</li> <li>risk assessments</li> <li>registration requirements</li> <li>safe work practices</li> <li>state and territory regulatory requirements</li> </ul>
<b>Legislative requirements</b>	<p>Legislative requirements may include:</p> <ul style="list-style-type: none"> <li>industrial law and awards</li> <li>customer protection law</li> <li>restrictive trade practice</li> <li>environmental protection</li> <li>workers compensation</li> <li>equality and antidiscrimination</li> <li>contract law</li> </ul>
<b>Sustainability</b>	<p>Sustainability includes consideration of economic, social, ecological and resources implications of activities. Sustainability issues may include:</p> <ul style="list-style-type: none"> <li>resources and energy: <ul style="list-style-type: none"> <li>sources, access, processing and consumption</li> <li>food security and agriculture, health, education and shelter</li> </ul> </li> <li>land, energy and water</li> </ul>

	<ul style="list-style-type: none"> <li>• social and economic factors affecting design of machines and equipment</li> <li>• life cycle design of product (manufacture to re-manufacture or recycle)</li> <li>• raw material, solids and hazardous waste, and production by-products</li> <li>• contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>• climate change</li> </ul>
<b>Standards and codes</b>	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design or engineering related task
<b>Planning and scheduling techniques</b>	<p>Planning and scheduling techniques may include:</p> <ul style="list-style-type: none"> <li>• critical path or Pert network plans</li> <li>• Gantt charts</li> </ul>
<b>Software and validation techniques</b>	<p>Advice may need to be offered on software and validation techniques. These include:</p> <ul style="list-style-type: none"> <li>• software employed for performance analysis/modelling (Underpinning program techniques and algorithms should be understood, such as the use of failure effects analysis (FEA) and numerical methods within object oriented modelling techniques)</li> </ul> <p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented design challenges which were completed using the software</li> </ul>

## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.



## **MEM234031A Manage installation, commissioning or modification of machines and equipment**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to provide the technical leadership role in the installation, commissioning or modification of machines and equipment. It includes interpreting manufacturer specifications, implications of relevant regulations, internal or external client brief, liaison with designers, and ensuring that team members are aware of technical and performance requirements.

### **Application of the Unit**

This unit applies to the installation, commissioning or modification of significant machines and equipment across all forms of manufacturing and engineering. The unit applies to individuals who are required to provide high level technical leadership to other members in the installation, commissioning or modification team. The other members of the team will normally include engineering tradespersons and may also include technicians and production personnel.

The unit complements the more general technical leadership and management skills found in MEM234001A Plan and manage engineering-related projects or operations. Informal technical or engineering advice situations are covered by the unit MEM234030A Provide specialised technical and engineering guidance to other technical employees.

This unit does not supply all technical skills and knowledge required for machine and equipment installation, commissioning or modification tasks. The required technical skills will depend on the particular task and will normally be covered through selection of relevant technical units as well as the combined skills and knowledge of the team. However, the unit presumes engineering skills and knowledge to at least Advanced Diploma level.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify scope of machine installation, commissioning or modification task	1.1	Examine machine and equipment drawings, manufacturer's manuals and other technical data on machines and equipment
		1.2	Determine performance and production requirements expected from machines and equipment after installation, commissioning or modification
		1.3	Determine relevant regulatory requirements
		1.4	Inspect site and determine appropriateness of structural supports, ventilation, services, security and other critical requirements
		1.5	Determine mechanical, electrical, fabrication and machine control skills and task requirements
		1.6	Produce or review installation, commissioning or modification schedule
2	Brief team on requirements	2.1	Distribute and discuss drawings, schedules, and major materials and equipment with team
		2.2	Arrange for request for further information (RFIs) with designers, where required
		2.3	Brief team on key compliance and risk factors, including regulatory, occupational health and safety (OHS) and environmental requirements

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|---|---|-----|---|
|   |   | 2.4 | Agree with team on critical control points and reporting requirements   |
| 3 | Commence installation, commissioning or modification task | 3.1 | Supervise machine and equipment shutdowns required for task   |
|   |   | 3.2 | Supervise unloading of any new machines, equipment and materials required for task  |
|   |   | 3.3 | Check and determine that supply of services to work are adequate for task commencement  |
|   |   | 3.4 | Ensure all tradespersons have correct drawings  |
| 4 | Monitor progress and deal with contingencies              | 4.1 | Establish procedures to ensure assembly and connections are against drawing specifications  |
|   |   | 4.2 | Ensure electrical, fluid power, and control systems and circuits are consistent with specifications and regulations   |
|   |   | 4.3 | Identify problems and contingencies and establish and rectify root cause  |
| 5 | Finalise installation, commissioning or modification      | 5.1 | Conduct final check to ensure installation, commissioning or modification is consistent with drawings, manufacturer manuals and any regulatory requirements |
|   |   | 5.2 | Conduct test run of equipment   |
|   |   | 5.3 | Identify and correct any malfunctions or errors in required output  |
| 6 | Conduct handover and finalise documentation               | 6.1 | Brief client and operators on machine or equipment operation after installation   |
|   |   | 6.2 | Prepare and submit any required reports on installation, commissioning or modification  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- performing responsibilities in priority order in accordance with implementation schedules
- investigating and validating performance analysis, modelling and simulation software
- interpreting machine and equipment design and detailed drawings, including the ability to:
  - identify materials and surface finishes used or required
  - apply assembly, fabrication and construction techniques used in the existing machinery or equipment and required for the installation, commissioning or modification task
  - identify systems and features of the machinery and equipment
- identifying sustainability and environmental issues and implications for the installation, commissioning or modification task
- selecting and using software and validation techniques, including 2-D and 3-D modelling
- identifying problems that require solutions involving computations, such as rate of change, moments of inertia and friction forces, and arranging for, or undertaking, the required computations
- identifying situations and issues that require additional technical or professional assistance
- evaluating solutions for feasibility against the installation, commissioning or modification criteria, including relevant engineering, and financial calculations and analysis
- selecting materials, equipment and sub-assemblies based on availability, price and performance characteristics
- establishing budget and control measures for team, and incorporating within installation, commissioning or modification project control plan
- delegating roles, responsibilities and levels of authority, as appropriate, to team members
- communicating, negotiating and reviewing with stakeholders and team members throughout duration of installation, commissioning or modification project

### Required knowledge

Required knowledge includes:

- purpose of and range of systems typically found in modern machinery and equipment including:
  - hydraulics
  - pneumatics
  - electrical motors, electrical supply and associated equipment
  - electronics, mechatronics and other control systems
  - mechanical transmissions, including gears, shafts and clutches
- force and stress analysis techniques

- requirements for, and functions of, technical documentation, graphics and specifications and records of meetings, communications, negotiations, decisions and agreements with stakeholders
- OHS requirements, codes of practice, regulations, standards, and regulatory requirements for project or operations
- risk management and reduction, current safe work methods statements, material safety data sheets (MSDS) and work permits
- professional and ethical practice
- conflict resolution, problem solving and decision making

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• determine features of machines or equipment, OHS, regulatory and risk management requirements both before and after installation, commissioning or modification</li><li>• lead a multi-disciplinary team</li><li>• measure, model, calculate and analyse using software and validation techniques</li><li>• analyse drawings and manufacturer specifications to determine machine and equipment systems and components</li><li>• determine steps and processes needed for machine and equipment installation</li><li>• determine steps and processes needed for machine and equipment commissioning</li><li>• determine steps and processes needed for machine and equipment modification</li><li>• innovate and create solutions to engineering-related contingencies</li><li>• verify machine and equipment performance to specifications after installation, commissioning or modification</li><li>• communicate, negotiate and review with stakeholders and client throughout installation, commissioning or modification process.</li></ul>
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Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Installation, commissioning or modification</b>	<p>Installation, commissioning or modification refers to machinery and equipment projects that have the following features:</p> <ul style="list-style-type: none"> <li>the performance of the whole machine or equipment must be verified against drawings, client brief and manufacturer specifications at the conclusion of the project</li> <li>skills and knowledge above the trade level are required for planning and supervising the installation, commissioning or modification project</li> <li>work is conducted against a formal design</li> </ul>
<b>RFIs</b>	<p>RFIs are formal queries to designers seeking clarifications or additional information to enable the installation, commissioning or modification project to proceed</p>
<b>Appropriate technical personnel and professionals</b>	<p>Appropriate technical and professional assistance may include:</p> <ul style="list-style-type: none"> <li>technical support and advice relating to elements which have intrinsic dangers, such as: <ul style="list-style-type: none"> <li>high pressure</li> <li>energised fluid vessels</li> <li>high temperatures and heat energy capacity</li> <li>wiring or devices with high current or voltages above extra low voltage</li> </ul> </li> <li>professional support for technologies, such as: <ul style="list-style-type: none"> <li>specialist electric motor drives and controllers</li> <li>specialist materials, plastics, metal alloys and nano materials</li> <li>special processes, foundry, alloy welding, heat treatment, sealing and fastening</li> </ul> </li> <li>professional services for: <ul style="list-style-type: none"> <li>finance, accounts and tax</li> <li>insurance and legal</li> <li>training and human resources (HR)</li> </ul> </li> </ul>

<b>OHS, regulatory, sustainability and environmental issues</b>	<p>OHS, regulatory, sustainability and environmental issues may include:</p> <ul style="list-style-type: none"><li>• OHS Acts and regulations</li><li>• relevant standards</li><li>• industry codes of practice</li><li>• risk assessments</li><li>• registration requirements</li><li>• safe work practices</li><li>• minimising ecological and environmental footprint of process, plant and product</li><li>• maximising economic benefit of process plant and product to the organisation and the community</li><li>• minimising the negative OHS impact on employees, community and customer</li><li>• state and territory regulatory requirements</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.



# **MEM234032A Manage fluid power related technologies in an enterprise**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills required to provide a technical leadership role in the installation, maintenance and productivity, quality enhancement of fluid-related technologies in an enterprise.

It includes awareness of current options and trends in fluid power design, interpreting manufacturer specifications, production requirements, implications of relevant regulations, internal or external client brief, liaison with designers and ensuring that team members are aware of technical and performance requirements.

## **Application of the Unit**

This unit applies to a technician who is providing technical leadership in the installation, maintenance and quality, productivity enhancement of fluid-related technologies in an enterprise, including fluid power control systems; hydraulic systems, including hydrostatic transmissions, proportional and servo valve control; and programmable logic controller (PLC) control.

The unit covers the fluid power technologies in equipment, such as robotics; fluid power drives; mobile equipment using fluid power; such as earthmoving equipment, compressors, pumps, and compressed air distribution systems across all forms of manufacturing and engineering.

The unit applies to individuals who are required to provide high level technical leadership to other members in the installation, commissioning or modification team. The other members of the team will normally include engineering tradespersons and may also include technicians and production personnel.

The unit complements the more general technical leadership and management skills found in MEM234001A Plan and manage engineering-related projects or operations. Informal technical or engineering advice situations are covered by the unit MEM234030A Provide specialised technical and engineering guidance to other technical employees.

This unit does not supply all technical skills and knowledge required for fluid power related tasks. The required technical skills will depend on the particular task and will normally be covered through the combined skills and knowledge of the team. However, the unit presumes engineering skill and knowledge to at least Advanced Diploma level.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify scope of fluid power related systems installation	1.1	Review machine and equipment drawings, manufacturer manuals and other technical data for fluid power systems specifications
		1.2	Determine performance and production requirements expected from fluid power equipment
		1.3	Determine if any commissioning or modification of fluid power systems are required to ensure production requirements are met
		1.4	Determine relevant regulatory requirements
		1.5	Inspect site and equipment to confirm or determine suitability, availability of other services and control requirements

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|---|---|-----|---|
|   |   | 1.6 | Produce or review fluid power management schedule, including any required installation, commissioning, modification or maintenance requirements |
| 2 | Brief team on fluid power work requirements                             | 2.1 | Distribute and discuss drawings, schedules, and major materials and equipment with team   |
|   |   | 2.2 | Arrange for request for further information (RFIs) with designers, where required   |
|   |   | 2.3 | Brief team on key compliance and risk factors, including regulatory, occupational health and safety (OHS) and environmental requirements        |
|   |   | 2.4 | Agree with team on critical control points and reporting requirements   |
| 3 | Commence installation, commissioning, modification or maintenance tasks | 3.1 | Supervise machine and equipment shutdowns required for task   |
|   |   | 3.2 | Confirm availability of equipment components and materials for scheduled fluid power tasks  |
|   |   | 3.3 | Check and determine that supply of services to work are adequate for task commencement  |
|   |   | 3.4 | Ensure all tradespersons have correct drawings  |
| 4 | Monitor progress and deal with contingencies                            | 4.1 | Establish procedures to ensure assembly and connections are against drawing specifications  |
|   |   | 4.2 | Ensure electrical, fluid power and control systems and circuits are consistent with specifications and regulations                              |
|   |   | 4.3 | Identify problems and contingencies and establish and rectify root cause  |
| 5 | Finalise fluid power installation, commissioning, modification or       | 5.1 | Conduct final check to ensure completed work is consistent with drawings, manufacturer manuals and any regulatory requirements                  |
|   |   | 5.2 | Conduct test run of equipment and system  |

6	maintenance tasks Conduct handover and finalise documentation	5.3	Identify and correct any malfunctions or errors in required output
		6.1	Brief client and operators on machine or equipment operation after installation
		6.2	Prepare and submit any required reports on installation, commissioning or modification

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- performing responsibilities in priority order in accordance with implementation schedules
- investigating and validating performance analysis, modelling and simulation software
- interpreting fluid power design and detailed drawings
- identifying sustainability and environmental issues and implications for the fluid power system
- selecting and using software and validation techniques, including 2-D and 3-D modelling
- identifying situations and issues that require additional technical or professional assistance
- evaluating solutions for feasibility against the installation, commissioning, modification or maintenance criteria, including relevant engineering and financial calculations and analysis
- establishing budget and control measures for team, and incorporating within installation, commissioning or modification project control plan
- delegating roles, responsibilities and levels of authority, as appropriate, to team members
- communicating, negotiating and reviewing with stakeholders and team members throughout duration of installation, commissioning or modification project

### Required knowledge

Required knowledge includes:

- current options and trends in fluid power modelling and simulation software, including underpinning programme techniques and software validation techniques
- research and investigations methods
- principles of fluid power systems
- dimensions, capacity and position of system components

- electrical and mechanical behaviours of fluid power systems and system responsiveness
- hydraulics and hydraulics components
- applications and characteristics of servo valves
- electronic controllers for proportional and servo valves
- sensor/transducer/amplifiers:
- pneumatics and designing with pneumatic components
- multiple actuator control circuits
- compressed air system design
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret plans, specifications and other documentation to determine features and performance characteristics and requirements of fluid power systems</li> <li>• advise other technicians, tradespersons and production personnel on fluid power installation, modification, commissioning, operation and maintenance</li> <li>• determine adequacy of standard operating procedures for fluid power systems and adjust, if required</li> <li>• check fluid power systems for safe operation, including automation safety</li> <li>• determine situations that require other technical and professional assistance</li> <li>• research sustainability implications and current industrial design techniques</li> <li>• determine OHS, regulatory and risk management requirements.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of</li> </ul>

	<p>conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>Sustainability</b>	<p>Sustainability may include:</p> <ul style="list-style-type: none"> <li>resources and energy</li> <li>social and economic</li> <li>life cycle design of product raw material, solids and hazardous waste, and production by-products</li> <li>contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>climate change</li> </ul>
<b>Appropriate software</b>	<p>Appropriate software may include software for:</p> <ul style="list-style-type: none"> <li>computer-aided design (CAD)</li> <li>circuit design and analysis</li> <li>animation</li> <li>simulation</li> <li>modelling</li> <li>performance analysis</li> </ul>
<b>Validation techniques</b>	<p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>review of previously implemented designs which were completed using the software</li> <li>use of failure modes and effects analysis (FMEA)</li> </ul>
<b>Fluid power related technologies</b>	<p>Fluid power related technologies refers to:</p> <ul style="list-style-type: none"> <li>hydraulic and pneumatic systems used for industrial and mobile equipment applications</li> </ul>
<b>Fluid power system maintenance</b>	<p>Fluid power systems maintenance refers to maintenance fluid power systems for fitness for purpose and includes:</p> <ul style="list-style-type: none"> <li>safety and integrity of the system</li> <li>adequacy and correct operations of controls</li> <li>automation safety</li> <li>adequacy of standard operating procedures for users</li> <li>safe integration with mechanical and electrical equipment</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>OHS Acts and regulations</li> <li>relevant standards</li> <li>industry codes of practice</li> <li>risk assessments</li> </ul>

	<ul style="list-style-type: none"> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards</b>	<p>Standards may include:</p> <ul style="list-style-type: none"> <li>• AS 4024.1-2006 Series Safety of machinery</li> <li>• AS/NZS ISO 31000:2009 Risk management – Principles and guidelines</li> <li>• NOHSC:1010 National standard for plant</li> <li>• NOHSC:1014 National standard for the control of major hazard facilities</li> <li>• AS 61508.1-2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – General requirements</li> </ul>
<b>Sequence and mode control methods for multi-actuator circuit</b>	<p>Sequence may include:</p> <ul style="list-style-type: none"> <li>• sequential operations with or without conditional jumps</li> <li>• optimisation techniques</li> <li>• functions such as: <ul style="list-style-type: none"> <li>• timing, counting, stop start, cycle selection and boundary conditions</li> </ul> </li> </ul> <p>Control methods may include:</p> <ul style="list-style-type: none"> <li>• pneumatic and electrical relay cascade control.</li> <li>• pneumatic and electrical relay step-sequenced control</li> <li>• PLC control</li> <li>• microcontrollers for special purpose machines</li> </ul>
<b>Stand alone and network control</b>	<p>Options for stand alone and network control of fluid power systems may include:</p> <ul style="list-style-type: none"> <li>• compressor control and application control</li> <li>• fluid powered machine control, including proportional-integral-derivative (PID) parameter control from remote host controller</li> <li>• communications bus systems, serial systems</li> <li>• distributed control systems (DCS)</li> <li>• system control and data acquisition (SCADA)</li> <li>• computer-integrated manufacture (CIM) options</li> </ul>



## **Unit Sector(s)**

Engineering practice

## **Custom Content Section**

Not applicable.

# **MEM234033A Lead engineering-related quality operations in an enterprise**

## **Modification History**

Not applicable.

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to provide a technical leadership role in the coordination of quality operations in an enterprise on an ongoing or project basis.

It includes knowledge of relevant regulations, interpreting internal or external client brief, liaison with designers and other professional and technical specialists, and ensuring that organisation members are aware of technical and performance requirements.

## **Application of the Unit**

This unit applies to a Principal Technical Officer or equivalent who is providing high level technical leadership in the coordination of engineering-related quality operations and quality-related projects across all forms of manufacturing and engineering, including small run/single lot production. The technical officer may provide this leadership working alone or with a team in which case other members of the team may include technicians, production personnel and engineering tradespersons.

The leadership situations covered by this unit include quality project or quality operations responsibilities that require significant understanding of the technologies, procedures and equipment used in the enterprise and the skills and capabilities required by the quality team in order to be effective.

The unit complements the more general technical leadership and management skills found in MEM234001A Plan and manage engineering-related projects or operations. Informal technical or engineering advice situations are covered by the unit MEM234030A Provide specialised technical and engineering guidance to other technical employees.

This unit does not supply engineering and mathematical skills and knowledge required for quality-related tasks. The required engineering and mathematical skills will depend on the particular processes and technologies used in the enterprise and will normally be covered through the combined skill and knowledge of the team. However, the unit presumes engineering skill and knowledge to at least Advanced Diploma level.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

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|---|--|-----|--|
| 1 | Set strategy for integration of quality operations with organisation, project goals and business plans | 1.1 | Prepare or review organisation formal policy documents and establish implications for quality operations   |
|   |  | 1.2 | Establish senior management expectations and objectives for quality department and communicate as appropriate  |
|   |  | 1.3 | Identify role of quality department in organisation, project or business plan including capability reporting, budgeting, and contribution to marketing and sales strategy and communicate to organisation, team as appropriate |
| 2 | Set key performance output variables   | 2.1 | Liaise with sales and marketing staff to identify external customer profiles and requirements  |
|   |  | 2.2 | Review internal customer specifications  |
|   |  | 2.3 | Set and manage required key performance output variables   |

- 2.4 Recommend any required changes to key performance output variables
- 3 Set key performance input variables
  - 3.1 Analyse drawings, specifications, procedures and regulatory requirements for project, product or process
  - 3.2 Set parameters for any capability studies of process or procedures, where appropriate
  - 3.3 Analyse data from capability studies of process or procedures, as required, and take appropriate action
  - 3.4 Identify key equipment, technologies procedures used and set performance input variables
  - 3.5 Identify current maintenance strategies, where appropriate
  - 3.6 Identify risks, vulnerabilities and critical control points
  - 3.7 Recommend any required changes to maintenance strategies in order to maintain quality performance
- 4 Implement quality operations
  - 4.1 Communicate key performance input and output variables to team, where appropriate
  - 4.2 Ensure key performance input and output variables are communicated to appropriate departments, including purchasing, logistics and dealer liaison, or directly along the value stream
  - 4.3 Allocate quality-related responsibilities to quality team
  - 4.4 Identify or set budget and other resources required for quality operation
  - 4.5 Establish reporting processes for quality team operations
  - 4.6 Establish and monitor data collection procedures, including integration with process control
  - 4.7 Identify and eliminate root causes of defective processes or procedures in participation with the processing departments and quality team
  - 4.8 Provide advice on work environments to enable

		employees to be responsible for quality of their own work
	4.9	Establish regular employee feedback on quality operations
5	Evaluate present, past performance and undertake risk assessment	<p>5.1 Ensure timely and effective communication from customer liaison of complaints, warranty claims and returns, where appropriate</p> <p>5.2 Analyse data for non-conformances to key performance input and output variables and establish root causes and recommend actions to be taken in conjunction with quality team</p> <p>5.3 Analyse risks to quality from supplier or distributor failure</p> <p>5.4 Identify performance levels required to maintain regulatory and commercial contractual compliance</p> <p>5.5 Communicate data throughout the organisation to assist in future improvements</p>
6	Establish procedures for engineering-related quality non-conformances	<p>6.1 Establish reporting procedures for quality non-conformances within the project, process or procedure across the organisation</p> <p>6.2 Establish short-term contingency procedures to cover non-conformances</p> <p>6.3 Allocate responsibilities to determine root cause and recommendations for corrective action, as appropriate</p>

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, negotiating and reviewing with stakeholders and team members throughout

project and operation duration

- providing leadership in quality functions and monitoring
- providing clear vision with ability to communicate goals
- assessing internal and external customer requirements, and establishing key output requirements
- assessing equipment, technologies and procedures for impact on quality, and establishing key input requirements, including appropriateness of maintenance strategies
- assessing suitability of standard operations procedures and recommending revisions, when required

## Required knowledge

Required knowledge includes:

- process, procedure quality management and improvement procedures, zero defects, six sigma or similar programs
- context of operations or project, such as competitive pressures or markets, customer-supplier relationships, regulatory and industrial environment, resourcing and labour issues
- statistical process control (SPC) techniques
- problem solving, root cause identification and elimination techniques
- benchmarking and role in setting quality related performance indicators
- conducting customer surveys to establish key quality issues
- liaison with customers on warranty claims and legal obligations
- maintenance strategies and implications for quality systems, such as total productive maintenance (TPM) and reliability centred maintenance (RCM)
- use of employee suggestion schemes, employee involvement, quality circles, and so on
- requirements for, and functions of, technical documentation, graphics and specifications and records of meetings, communications, negotiations, decisions and agreements with stakeholders

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"><li>• identify, plan and establish key quality input and output variables, and requirements for the project, procedure or operation</li><li>• establish resources required, including labour, materials,</li></ul>
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	<ul style="list-style-type: none"> <li>and equipment within budgets and procedures</li> <li>commence project or operation management, including establishing, where required, support team and responsibilities</li> <li>overcome constraints to achievement of the quality objectives</li> <li>undertake appropriate internal and external reporting</li> <li>investigate and validate quality performance analysis, and manage continuous improvement</li> <li>undertake customer liaison, including surveys, warranty claim analysis and returns.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>This unit may be assessed on the job, or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>

	Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Organisation formal policy documents</b>	<p>Organisation formal policy documents are those that have Board and/or senior management approval and include:</p> <ul style="list-style-type: none"> <li>• vision statements</li> <li>• organisation goals</li> <li>• annual reports</li> <li>• business plans</li> <li>• regulatory reports</li> </ul>
<b>Quality team</b>	<p>For this unit the term quality team means all employees, and in some cases suppliers and customers, who have a role in ensuring the quality of products and processes meet specifications. The quality team may be:</p> <ul style="list-style-type: none"> <li>• a formally designated team consisting of employees allocated full or part time to a quality role or a group of employees who have quality responsibilities as part of their normal job role</li> </ul>
<b>Coordination of the quality role</b>	<p>Coordination of the quality role includes:</p> <ul style="list-style-type: none"> <li>• aligning enterprise outputs products or services with customer requirements</li> <li>• identifying defective processes or procedure</li> <li>• establishing the engineering related key process input/output variables</li> <li>• establishing action plans and putting control systems in place</li> </ul> <p>Coordination may also include:</p> <ul style="list-style-type: none"> <li>• contributing to current or new product, process or procedure design</li> </ul>



<b>External customer profiles and requirements</b>	<p>External customer profiles and requirements may include:</p> <ul style="list-style-type: none"> <li>• analysis of customer surveys</li> <li>• existing profiles</li> <li>• past orders</li> <li>• other communication and documentation</li> </ul>
<b>Internal customer specifications</b>	<p>Internal customer specifications may include:</p> <ul style="list-style-type: none"> <li>• employee surveys</li> <li>• operating procedures</li> <li>• drawings</li> <li>• other documentation/records</li> </ul>
<b>Maintenance strategies</b>	<p>Maintenance strategies include:</p> <ul style="list-style-type: none"> <li>• TPM</li> <li>• RCM</li> <li>• failure modes and effects analysis (FMEA)</li> <li>• proactive maintenance</li> <li>• breakdown or corrective maintenance</li> </ul>
<b>Areas of responsibilities for quality team members</b>	<p>Responsibilities for quality team members may be allocated on a departmental or functional basis. Examples of functional responsibilities include:</p> <ul style="list-style-type: none"> <li>• statistical data collection and analysis</li> <li>• non-conformances</li> <li>• managing quality performance of new products or processes</li> <li>• customer liaison, including surveys, warranty claim analysis and returns</li> <li>• contributing to design processes to ensure quality objectives are taken into account</li> </ul> <p>Examples of functional quality responsibilities include:</p> <ul style="list-style-type: none"> <li>• production</li> <li>• maintenance</li> <li>• support services, including engineering-related quality logistics, administration and purchasing</li> </ul>
<b>Engineering-related quality advice on work environment</b>	<p>Engineering-related quality advice on work environments includes advice on:</p> <ul style="list-style-type: none"> <li>• skills development needed to enable employees to achieve quality targets</li> <li>• workstation design, including jigs and fixtures</li> <li>• equipment operation and machine and tool setting specifications</li> <li>• plant layout</li> </ul>

	<ul style="list-style-type: none"><li>• inspection procedures</li><li>• standardisation of processes</li></ul>
<b>Employee feedback</b>	Employee feedback may include: <ul style="list-style-type: none"><li>• toolbox meetings, quality circles</li><li>• suggestion schemes</li><li>• regular meetings between quality team, supervisors and employees</li><li>• production and error reports</li></ul>

## Unit Sector(s)

Not applicable.

## Custom Content Section

Not applicable.

# **MEM234034A Manage heating, ventilation, air conditioning and refrigeration systems or projects**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to provide a technical leadership role in the installation, modification, commissioning or ongoing management of heating, ventilation, air conditioning and refrigeration (HVAC/R) systems.

It includes awareness of current options and trends in (HVAC/R) design, analysis of existing sites and systems, interpreting manufacturer specifications, implications of relevant regulations, internal or external client brief, liaison with designers, and ensuring that team members are aware of technical and performance requirements.

## **Application of the Unit**

This unit applies to all forms of manufacturing and engineering where a technician who is providing technical leadership in HVAC/R system projects or management. The unit assumes that the system or modification has already been designed.

The unit applies to individuals who are required to provide high level technical leadership to other members in HVAC/R installation, commissioning, modification, maintenance or management. The other members of the team will normally include engineering tradespersons and may also include technicians and production personnel.

Prior or concurrent experience in the HVAC/R control systems, hydronic and refrigeration systems and thermal loads, electrical principles, controller programming and computing is required.

The unit complements the more general technical leadership and management skills found in MEM234001A Plan and manage engineering-related projects or operations. Informal technical or engineering advice situations are covered by the unit MEM234030A Provide specialised technical and engineering guidance to other technical employees.

This unit does not supply all technical skills and knowledge required for HVAC/R related tasks. The required technical skills will depend on the particular task and will normally be covered through the combined skill and knowledge of the team. However the unit presumes engineering skill and knowledge to at least Advanced Diploma level.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify scope of HVAC/R system installation	1.1	Review HVAC/R system drawings, manufacturer manuals and other technical data for system specifications
		1.2	Determine HVAC/R system performance requirements
		1.3	Determine if any commissioning or modification actions are required to ensure performance requirements are met
		1.4	Determine relevant regulatory requirements
		1.5	Inspect site and any existing HVAC/R equipment to confirm or determine suitability, availability of other services and control requirements
		1.6	Produce or review HVAC/R system management schedule, including any required installation,

		commissioning, modification or maintenance requirements
	1.7	Integrate building management systems (BMS) considerations into the schedule, where required
2	Brief team on HVAC/R system work requirements	<p>2.1 Distribute and discuss drawings, schedules, and major materials and equipment with team</p> <p>2.2 Arrange for request for further information (RFIs) with designers, where required</p> <p>2.3 Brief team on key compliance and risk factors, including regulatory, occupational health and safety (OHS) and environmental requirements</p> <p>2.4 Agree with team on critical control points and reporting requirements</p>
3	Commence installation, commissioning, modification or maintenance tasks	<p>3.1 Supervise any equipment shutdowns required for task</p> <p>3.2 Confirm availability of equipment components and materials for scheduled tasks</p> <p>3.3 Check and determine that supply of services to work are adequate for task commencement</p> <p>3.4 Ensure all tradespersons have correct drawings</p>
4	Monitor progress and deal with contingencies	<p>4.1 Establish procedures to ensure installation, commissioning or modification are against design specifications</p> <p>4.2 Ensure electrical and HVAC/R control systems and circuits are consistent with specifications and regulations</p> <p>4.3 Identify problems and contingencies and establish and rectify root cause</p>
5	Finalise HVAC/R system work requirements	5.1 Conduct final check to ensure completed work is consistent with drawings, manufacturer manuals and any regulatory requirements

- |   |   |  |
|---|---|--|
|   | 5.2   | Conduct test run of equipment and system   |
|   | 5.3   | Identify and correct any malfunctions or errors in required output                         |
| 6 | Conduct handover and finalise documentation | 6.1 Brief client and operators on machine or equipment operation after installation        |
|   |   | 6.2 Prepare and submit any required reports on installation, commissioning or modification |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- performing responsibilities in priority order in accordance with implementation schedules
- investigating and validating performance analysis, modelling and simulation software
- interpreting HVAC/R system specifications, including design and detailed drawings
- identifying sustainability and environmental issues and implications for the HVAC/R system
- selecting and using software and validation techniques, including 2-D and 3-D modelling
- identifying situations and issues that require additional technical or professional assistance
- evaluating solutions for feasibility against the installation, commissioning, modification or maintenance criteria, including relevant engineering and financial calculations and analysis
- establishing budget and control measures for team and incorporation within installation, commissioning or modification project control plan
- delegating roles, responsibilities and levels of authority, as appropriate, to team members
- communicating, negotiating and reviewing with stakeholders and team members throughout duration of installation, commissioning or modification project

### Required knowledge

Required knowledge includes:

- current options and trends in HVAC/R system modelling and simulation software, including underpinning program techniques and software validation techniques
- research and investigations methods
- principles of HVAC/R systems

- types of control equipment
- common HVAC/R system hardware, including industrial and commercial refrigeration systems, hydronic systems and automated controls
- HVAC/R load cycles
- BMS principles
- interface principles for HVAC/R system components
- building management control system software
- dimensions, capacity and position of system components
- electrical, electronic and mechanical features of HVAC/R systems, including interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret plans, specifications and other documentation to determine features and performance characteristics and requirements of HVAC/R systems</li> <li>• advise other technicians, tradespersons and production personnel on HVAC/R systems installation, modification, commissioning, operation and maintenance</li> <li>• determine adequacy of standard operating procedures for HVAC/R systems and adjust, if required</li> <li>• check HVAC/R systems for safe operation</li> <li>• determine situations that require other technical and professional assistance</li> <li>• research sustainability implications and current HVAC/R systems design techniques</li> <li>• determine OHS, regulatory and risk management requirements.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace</li> </ul>

	<p>situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <ul style="list-style-type: none"> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>HVAC/R system work</b>	HVAC/R system work requirements include:
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<b>requirements</b>	<ul style="list-style-type: none"> <li>• specific installation, commissioning, modification and maintenance projects as well as regular scheduled operation and maintenance tasks identified in the HVAC/R system management schedule</li> </ul>
<b>Sustainability</b>	<p>Sustainability may include:</p> <ul style="list-style-type: none"> <li>• resources and energy</li> <li>• social and economic</li> <li>• life cycle design of product raw material, solids and hazardous waste, and production by-products</li> <li>• contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>• climate change</li> </ul>
<b>Appropriate software</b>	<p>Appropriate software may include software for:</p> <ul style="list-style-type: none"> <li>• computer-aided design (CAD)</li> <li>• HVAC/R design and analysis including: <ul style="list-style-type: none"> <li>• animation</li> <li>• simulation</li> <li>• modelling</li> <li>• performance analysis</li> </ul> </li> </ul>
<b>Validation techniques</b>	<p>Validation techniques include:</p> <ul style="list-style-type: none"> <li>• comparison of traditional solutions for simple design problems with software solutions to the same design problems</li> <li>• review of previously implemented designs which were completed using the software</li> <li>• use of failure modes and effects analysis (FMEA)</li> </ul>
<b>HVAC/R system maintenance</b>	<p>HVAC/R system maintenance refers to maintenance for fitness for purpose and includes:</p> <ul style="list-style-type: none"> <li>• safety and integrity of the system</li> <li>• adequacy and correct operations of controls</li> <li>• user performance requirements</li> <li>• adequacy of standard operating procedures for users</li> <li>• safe integration with other systems, including mechanical, electrical and fuel-fired equipment</li> </ul>
<b>Given environments</b>	<p>Given environments may include:</p> <ul style="list-style-type: none"> <li>• workplaces</li> <li>• food halls</li> <li>• restaurants</li> <li>• hotels</li> <li>• hospitals</li> </ul>

	<ul style="list-style-type: none"> <li>• domestic dwellings</li> <li>• industrial sites, factories, warehouses and cold storage areas</li> <li>• transport and refrigerated vehicles and trains</li> </ul>
<b>System specifications</b>	<p>System specifications may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• ducts and duct systems: <ul style="list-style-type: none"> <li>• materials</li> <li>• supports</li> <li>• factory and field fabricated</li> <li>• sealants</li> <li>• layout and placements</li> </ul> </li> <li>• capacity</li> <li>• zoning</li> <li>• heating and cooling loads</li> <li>• air flow and pressures</li> <li>• refrigerants</li> <li>• energy efficiency</li> <li>• air intake points</li> <li>• control equipment</li> <li>• monitoring equipment</li> </ul>
<b>BMS</b>	<p>BMS include:</p> <ul style="list-style-type: none"> <li>• HVAC/R control systems and may also include fire, security, and lighting controls</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Standards</b>	<p>Standards may include:</p> <ul style="list-style-type: none"> <li>• AS 4024.1-2006 Series Safety of machinery</li> <li>• AS/NZS ISO 31000:2009 Risk management – Principles and guidelines</li> <li>• NOHSC:1010 National standard for plant</li> <li>• NOHSC:1014 National standard for the control of major hazard facilities</li> <li>• AS 61508.1-2011 Functional safety of electrical/electronic/programmable electronic safety-related systems – General requirements</li> </ul>

## **Unit Sector(s)**

Engineering practice

## **Custom Content Section**

Not applicable.

# **MEM234035A Maintain and apply technical and engineering skills**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required by a Principal Technical Officer, or someone in an equivalent position, to plan and manage their own technical role and development in their field of engineering for the benefit of themselves and their organisation. It covers the technical, analytical, communication and system skills to ensure effective performance in complex technical and engineering environments.

## **Application of the Unit**

This unit applies to Principal Technical Officers and others in equivalent engineering and engineering-related positions in an organisation. The unit covers the skills required for an individual to manage their engineering role and provides the core underpinning skills for an individual to appropriately apply technical skills gained from other units of competency in the MEM80111 Vocational Graduate Diploma of Engineering. This unit applies to an individual performing high level engineering-related work whether in a project management, supervisory or technical specialist role in an organisation. The unit covers skills associated with ensuring that the individual's skills and knowledge in their chosen discipline or area of responsibility are up to date and appropriate for their work.

The unit applies across all forms of manufacturing and engineering. The unit covers high level technical, analytical, communication and system thinking skills.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |   |
|---|---|---|
| 1 | Develop, apply and maintain capacity for analysis   | <p>1.1 Demonstrate a systematic approach to investigation, analysis and solution of broadly defined engineering and related problems</p> <p>1.2 Analyse causes and effects of non-conformances</p> <p>1.3 Identify issues which require specialist assistance or have implications beyond personal expertise</p> <p>1.4 Use modelling, prototyping, tests and/or experiments to support problem solving</p> <p>1.5 Interpret, apply and verify compliance with relevant legislation, standards and codes of practice</p> <p>1.6 Determine properties, performance, safe working limits, failure modes, and/or other inherent parameters of materials, components and systems relevant to specialist area of expertise</p> <p>1.7 Apply research and communication techniques to access external reference material and assistance</p> <p>1.8 Report results of analysis and propose solutions that are appropriate to the needs of the organisation</p> <p>1.9 Share and encourage review of work by others in organisation</p> |
| 2 | Communicate in a manner appropriate for content and | <p>2.1 Actively communicate with others, as appropriate, including listening to, and critically and fairly comprehending, the viewpoints of others</p> <p>2.2 Express information effectively and succinctly</p>  |

audience	2.3	Communicate formally and informally, as required, with technically competent and non-technically competent individuals and groups in a manner appropriate to their level of knowledge and competency	
	2.4	Present clear arguments and justification for recommendations	
	2.5	Use textual, diagrammatic, pictorial and graphical media, as required, and as appropriate to the context	
	2.6	Prepare relevant and comprehensive engineering-related documents and reports, as required	
3	Work within the quality systems and management practices that apply to the organisation	3.1	Apply principles of safety engineering
		3.2	Understand the role of quality management systems
		3.3	Work effectively on engineering-related project activity
		3.4	Respect and accommodate the broader context of engineering work within the organisation
4	Maintain and apply technical and engineering skills in a professional manner	4.1	Identify own area of expertise and responsibility in the organisation and relate to one or more engineering disciplines
		4.2	Show familiarity with current state of development and recent applications in area of specialist knowledge or discipline
		4.3	Demonstrate a knowledge of the key scientific and engineering principles relevant to own area of specialist knowledge or discipline
		4.4	Apply, adapt and manage engineering knowledge and practice in a variety of contexts and applications
		4.5	Work from first principles, when appropriate
		4.6	Identify and select relevant materials, components, devices, systems, processes, resources, plant and equipment using appropriate reference materials and own knowledge to meet briefs

- 4.7 Demonstrate commitment to sustainable engineering practices and the achievement of sustainable outcomes in all facets of technological project work
- 4.8 Monitor and suggest improvements to the technical framework of the organisation through monitoring of developments in own discipline

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating, negotiating and reviewing complex technical information and processes with a variety of stakeholders and across different levels of technical understanding
- managing resources
- managing budgets
- scheduling and prioritising engineering and related activities
- complying with OHS and regulatory requirement
- performing work requiring mature technical knowledge involving a high degree of autonomy, and independent judgment, and without requiring detailed instructions
- identifying need for professional development and further education and training when reviewing own capability to undertake designated work
- providing specialised technical guidance to other employees performing work within the same technical field
- preparing engineering and related documentation
- preparing specifications, graphics and reports, as required

### Required knowledge

Required knowledge includes:

- the nature of the work of professions and occupations within the organisation and the impact their work may have on relevant engineering and related activities
- methods and opportunities for professional development, including knowledge or means of identifying relevant journals, short courses and seminars, and industry and technical associations
- context and limitations associated with delegated responsibilities within the organisation, including role and responsibilities for subordinates and others working in own technical field who may not have equivalent technical knowledge

- context and limitations associated with delegated responsibilities related to OHS and regulatory requirements, organisation business plan and budgets and financial objectives
- organisation management and operations control systems
- document management systems operation
- sustainability issues relevant to own engineering activities, including, where relevant:
  - environmental (e.g. water, land, air pollution, recycling, life cycle design and waste minimisation)
  - efficient use of materials and energy
- methods of formal and informal communication, including all forms of verbal and electronic means required to maintain information flow and perform functions

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• determine the scope of their technical skills and identify when they should seek assistance</li> <li>• follow a planned and systematic approach to technical tasks and own professional development</li> <li>• provide detailed technical advice in own area of expertise to others</li> <li>• communicate complex technical information effectively to a variety of audiences.</li> </ul>
Context of and specific resources for assessment	<ul style="list-style-type: none"> <li>• This unit should be assessed may be assessed in conjunction with technical focused units in the MEM80111 Vocational Graduate Diploma of Engineering.</li> <li>• Assessment may be conducted on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to</li> </ul>



	<p>accommodate ethnicity, age, gender, demographics and disability.</p> <ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>internal and external customers</li> <li>own team members</li> <li>other employees, including professional engineers,</li> </ul>
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	<p>technicians, tradespersons and operators</p> <ul style="list-style-type: none"> <li>• support services and departments, such as maintenance, accounts and logistics</li> <li>• regulators</li> <li>• the general community</li> </ul>
<b>Non-conformance</b>	<p>A non-conformance is an occurrence in a process, operation, design or product that is outside planned specifications. Examples of non-conformances include:</p> <ul style="list-style-type: none"> <li>• equipment breakdowns and faults</li> <li>• product returns and warranty claims</li> <li>• software errors</li> <li>• cost overruns</li> <li>• design faults</li> <li>• non-compliance to a customer brief</li> <li>• breaches of statutory requirements</li> </ul>
<b>Working from first principles</b>	<p>Occasionally an individual will be required to work from first principles in their chosen area of engineering. The term first principles is used to indicate:</p> <ul style="list-style-type: none"> <li>• that in solving a particular issue or problem the individual will be required to start their work directly at the level of established laws of physics and science, including fundamental calculations in their technological area of expertise</li> </ul>
<b>Documentation and reports</b>	<p>Documentation and reports covers those that must be produced by the individual and those that must be read and/or followed by the individual in the course of their engineering work. Examples of documentation and reports include:</p> <ul style="list-style-type: none"> <li>• progress reports</li> <li>• project plans</li> <li>• technical investigations and feasibility studies</li> <li>• proposals</li> <li>• manufacturer specifications and workshop manuals</li> <li>• operating procedures</li> <li>• customer instructions</li> <li>• design records,</li> <li>• engineering drawings</li> </ul>
<b>OHS requirements</b>	<p>OHS requirements may include:</p> <ul style="list-style-type: none"> <li>• OHS Acts and regulations</li> <li>• relevant standards</li> <li>• industry codes of practice</li> </ul>

	<ul style="list-style-type: none"> <li>• risk assessments</li> <li>• registration requirements</li> <li>• safe work practices</li> <li>• state and territory regulatory requirements</li> </ul>
<b>Non-engineering related objectives</b>	<p>Particular engineering tasks and projects may require working to achieve objectives or within constraints that are not directly related to an engineering discipline. These may include objectives relating to:</p> <ul style="list-style-type: none"> <li>• budgets and other financial management</li> <li>• sales and marketing</li> <li>• environment</li> <li>• human resources (HR)</li> <li>• relationship with the broader community</li> </ul>
<b>Sustainability</b>	<p>Sustainability includes consideration of economic, social, ecological and resources implications of activities. Sustainability issues may include:</p> <ul style="list-style-type: none"> <li>• resources and energy: <ul style="list-style-type: none"> <li>• sources, access, processing and consumption</li> <li>• food security and agriculture, health, education and shelter</li> <li>• land, energy and water</li> </ul> </li> <li>• social and economic factors affecting design of machines and equipment:</li> <li>• life cycle design of product (manufacture to re-manufacture or recycle)</li> <li>• raw material, solids and hazardous waste, and production by-products</li> <li>• contamination of land, air and stormwater pollutants, and discharge to sewerage</li> <li>• climate change</li> </ul>
<b>Legislation, standards and codes of practice</b>	<p>Legislation, standards and codes of practice refer to all relevant Australian and international standards and codes applicable to a particular engineering-related task. Examples include:</p> <ul style="list-style-type: none"> <li>• AS 4024.1-2006 Series Safety of machinery</li> <li>• AS/NZS ISO 31000:2009 Risk management – Principles and guidelines</li> <li>• NOHSC:1010 National standard for plant</li> <li>• NOHSC:1014 National standard for the control of major hazard facilities</li> <li>• OHS legislation and regulations</li> <li>• industrial law and awards</li> </ul>

	<ul style="list-style-type: none"><li>• trade practices</li><li>• environmental protection</li><li>• workers compensation</li><li>• equality and antidiscrimination</li><li>• contract law</li><li>• Australian and international standards</li></ul>
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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.

# **MEM234036A Apply configuration management procedures in engineering project management**

## **Modification History**

Release 1 (MEM05v9)

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply configuration management as a formal control mechanism that may be used in conjunction with the systems engineering process during initial design and during modification development. The outputs are configuration documentation that may be used to control the design baseline throughout the life of a product or for data input to logistics management plans where integrated logistics support (ILS) is the overarching through-life management system.

## **Application of the Unit**

This unit applies to engineering or related projects or operations across all forms of manufacturing and engineering. It is suitable for people with system design, installation, commissioning and project or operational management responsibilities who are required to apply configuration management (CM) procedures during system design and/or during the life cycle of a product. The procedures are used as the control mechanism during the application of the systems engineering design processes which may be used in the design of complex hardware and software products, both for initial design and then as an iterative process as the need for modifications are identified throughout the life cycle of the product. The outputs of the CM process are configuration documentation that can be used for through-life management or for input of data to logistic management plans where ILS is mandated as the through-life management system.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23003A	Operate and program computers and/or controllers in engineering situations
MEM234028A	Produce and manage technical documentation
MEM234029A	Produce and manage technical publications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |                                     |     |  |
|---|-------------------------------------|-----|--|
| 1 | Plan CM activities                  | 1.1 | Identify the context and environment in which CM is to be applied  |
|   |                                     | 1.2 | Identify any contractual requirements and specifications for the application of CM procedures to through-life management of product configuration, including the relationship with logistics management systems, such as ILS |
|   |                                     | 1.3 | Document the required CM activities  |
| 2 | Develop CM plan                     | 2.1 | Describe how CM is to be accomplished  |
|   |                                     | 2.2 | Specify how consistency between the product definition, configuration and the configuration management records is to be achieved and maintained throughout the applicable phases of the product's life cycle                 |
|   |                                     | 2.3 | Identify and specify performance indicators for assessing the effectiveness of the plan in terms of implementation and performance of the CM discipline  |
| 3 | Specify and set up CM documentation | 3.1 | Identify records required to effectively implement CM within the identified product context and environment and CM plan  |
|   |                                     | 3.2 | Select documentation media and develop documentation templates   |

- |   |   |     |  |
|---|---|-----|--|
|   |   | 3.3 | Specify a document version control system  |
| 4 | Establish and control CM baseline       | 4.1 | Establish product CM baseline in relation to the systems engineering or other design process   |
|   |   | 4.2 | Revise CM baseline at applicable stages of product development, production and engineering changes in accordance with the CM plan                                      |
|   |   | 4.3 | Establish and review documentation baselines in line with the requirements of the CM plan and with changes in the product CM baseline                                  |
| 5 | Implement CM processes                  | 5.1 | Develop and deliver training to responsible individuals covering roles and responsibilities and the procedures for implementing CM processes as defined in the CM plan |
|   |   | 5.2 | Measure performance against the performance indicators in the CM plan and assess measurements/trends to identify possible process improvements                         |
| 6 | Perform configuration status accounting | 6.1 | Develop and populate a database with information relating to the configuration of products classified as configuration items (CIs)                                     |
|   |   | 6.2 | Develop and promulgate procedures to update and validate the database whenever there is a configuration change throughout product life cycle                           |
|   |   | 6.3 | Disseminate data in accordance with the CM plan and standard enterprise procedures   |
| 7 | Participate in configuration audits     | 7.1 | Participate in configuration audits where required by the applicable CM standard and the CM plan   |
|   |   | 7.2 | Initiate action to correct deficiencies identified during audits   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying CM requirements for a product, including listing CIs
- applying CM processes to the data produced through systems engineering
- establishing CM baselines during product design and development
- developing a CM plan
- training organisation staff in CM plan implementation
- developing CM documentation and related access, version control and security protocols
- implementing and reviewing CM for a product
- developing and applying CM status accounting and maintain baseline records
- participating in configuration audits and initiate action to resolve deficiencies
- inputting CM data to logistic support plans, where applicable

### Required knowledge

Required knowledge includes:

- the use and application of CM in through-life management of product configuration
- CM standards and procedures
- relationship between CM and systems engineering during initial design and production
- iteration of the CM and systems engineering interface throughout the product life cycle during modification development and configuration baseline revision
- relationship between CM and logistic support requirements, such as providing data and updates for ILS plans throughout the product life cycle

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently: <ul style="list-style-type: none"><li>• determine the scope of the CM task and identify items for CM (CIs)</li><li>• compile CM documentation from systems engineering data</li><li>• establish and review configuration baselines during product development and production</li></ul>
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	<ul style="list-style-type: none"> <li>• develop CM plans</li> <li>• implement CM plans</li> <li>• review CM performance</li> <li>• establish and maintain CM status accounting databases and procedures</li> <li>• participate in CM audits and manage the remedy of deficiencies.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for</b>	Assessment processes and techniques must be culturally

<b>assessment</b>	appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>CM context and environment</b>	<p>CM context and environment may include:</p> <ul style="list-style-type: none"> <li>the nature of the products, such as hardware and/or software, complete systems and system components or subsystems</li> <li>whether or not CM must extend to subcontractors and/or vendors</li> <li>specific CM value adding functions and level of emphasis</li> <li>contractual CM requirements, including specification of a CM standard to be applied</li> </ul>
<b>Relationship with logistic management systems</b>	<p>Data from CM documentation may be used in logistic management system activities, such as:</p> <ul style="list-style-type: none"> <li>reliability and maintainability engineering</li> <li>maintenance planning</li> <li>life cycle costing</li> <li>spares support requirements</li> <li>technical data and publications</li> <li>support and test equipment identification</li> <li>determining facilities requirements</li> <li>determining personnel training requirements</li> </ul>
<b>CM plan</b>	<p>The contents of CM plans may include topics such as:</p> <ul style="list-style-type: none"> <li>brief description of system or top level CI and of the lower level CIs covered by the plan</li> <li>list of reference documents (e.g. specifications, standards and manuals)</li> <li>CM organisation and responsibilities</li> <li>CM phasing and milestones</li> <li>data management</li> <li>configuration identification, including selection of CIs, baseline establishment, and configuration</li> </ul>

	<p>identifiers for hardware and for software</p> <ul style="list-style-type: none"> <li>• interface management</li> <li>• performance indicators</li> <li>• configuration control procedures</li> <li>• configuration status accounting procedures</li> <li>• configuration audit procedures</li> <li>• subcontractor/vendor control procedures</li> </ul>
<b>Systems engineering interface</b>	<p>Systems engineering processes result in the output of technical information that is controlled through the CM process. Through the service life of the product the CM process identifies the need for modifications and the systems engineering process is used to design and develop the modifications which then result in changes to the CM baseline and documentation which may then also feed into logistic support plan updates</p>
<b>CM standards and references</b>	<p>CM standards and references include:</p> <ul style="list-style-type: none"> <li>• EIA-649-A 2004 National Consensus Standard for Configuration Management</li> <li>• GEIA Standard 836-2002 Configuration Management Data Exchange and Interoperability</li> <li>• IEEE Standard 828-1998 IEEE Standard for Software Configuration Management Plans</li> <li>• MIL-STD-973 Configuration Management</li> <li>• STANAG 4159 NATO Materiel Configuration Management Policy and Procedures for Multinational Joint Projects</li> <li>• STANAG 4427 Introduction of Allied Configuration Management Publications</li> <li>• IEEE Standard 1042-1987 IEEE Guide to Software Configuration Management</li> <li>• MIL-HDBK-61A Configuration Management Guidance</li> <li>• 10007 Quality management – Guidelines for configuration management</li> <li>• GEIA-HB-649 Implementation Guide for Configuration Management</li> <li>• EIA-836 Consensus Standard for Configuration Management Data Exchange and Interoperability</li> <li>• ANSI/EIA-632-1998 Processes for Engineering a System</li> </ul>

## **Unit Sector(s)**

### **Competency field**

**Unit sector**            Engineering science

## **Custom Content Section**

Not applicable.

# **MEM234037A Perform maintenance-related integrated logistic support management activities**

## **Modification History**

Release 1 (MEM05v9)

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to perform a range of maintenance-related integrated logistic support (ILS) activities at a managerial level for any complex system or product where ILS has been selected as the through-life management system.

## **Application of the Unit**

This unit requires application of competencies relating to ILS elements and related data management and analysis tools in the maintenance-related management and support of systems/products throughout their life of type.

Applications include the planning and support of maintenance on any complex system or product where ILS has been selected as the through-life management system and also includes the application of data produced through the configuration management (CM) process where that process has been selected to establish and maintain the design baseline of a system or product. Application of the CM process is covered by unit MEM234036A Apply configuration management procedures in engineering project management.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM23003A	Operate and program computers and/or controllers in engineering situations
MEM234028A	Produce and manage technical documentation
MEM234029A	Produce and manage technical publications

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Assist to develop and maintain logistic support analysis plans	1.1	Draft technical content for logistic support analysis plans
		1.2	Review the technical content of logistic support analysis plans in line with trends in system supportability and affordability and with changes in the design baseline
		1.3	Propose revisions to logistic support analysis plans
2	Perform life cycle cost analysis	2.1	Identify actual and anticipated costs through to life of type
		2.2	Analyse cost data
3	Establish and maintain baselines for reliability, availability and maintainability	3.1	Gather data on in-service reliability, availability and maintainability (RAM) and establish baselines
		3.2	Review data against established baselines and initiate action to deal with deviations from the established baselines
4	Develop and maintain a maintenance plan and identify associated	4.1	Perform a level of repair analysis (LORA)
		4.2	Specify maintenance activities and timelines
		4.3	Identify and document support and test equipment requirements

	requirements	4.4	Identify and document skills and maintenance manpower requirements
		4.5	Identify and document requirements for maintenance facilities
		4.6	Identify and document technical documentation requirements
		4.7	Provide data for initial spares assessment
		4.8	Revise the maintenance plan and applicable associated requirements when required by baseline changes
5	Revise technical logistic support analysis record data	5.1	Analyse logistic support analysis parameters using current data
		5.2	Enter analysis results in the logistic support analysis record
6	Manage data	6.1	Develop and manage a technical data management system in accordance with contractual and regulatory requirements
		6.2	Monitor the relevance of technical data and initiate amendment action, where necessary
		6.3	Apply and support logistic support management information systems

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- effectively using all forms of oral and written communication
- populating and extracting data from databases
- applying data from design sources, such as CM data
- performing task analysis
- applying ILS principles

## Required knowledge

Required knowledge includes:

- ILS management and support philosophy and practice
- logistic support analysis concepts and methods, including:
  - preparation of logistic support analysis plans
  - management and conduct of logistic support analysis programs
  - supportability analysis
  - task analysis
  - logistic support analysis record population
- RAM determination and application, including:
  - baseline determination and application
  - RAM modelling
  - reliability and maintainability apportionment
- performance of LORA and development of maintenance plans and associated requirements
- data management concepts and methods

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts for the maintenance-related application of ILS.
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li><li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li><li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li></ul>



	<ul style="list-style-type: none"> <li>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Technical data for logistics plans</b>	Technical data may be sourced from design data taken from CM data during the design and production phase and thereafter from maintenance records and data gathered to comply with organisational and/or regulatory requirements, plus the iteration of the CM process whenever modification action is required
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<b>Life cycle cost analysis</b>	Life cycle cost analysis includes the systematic identification and analysis of all actual and anticipated costs associated with implementing and sustaining a system or product throughout its service life
<b>Costs through to life of type</b>	Costs through to life of type may arise from: <ul style="list-style-type: none"> <li>• operation</li> <li>• engineering support</li> <li>• maintenance support</li> <li>• supply support</li> <li>• facilities costs</li> <li>• personnel costs</li> </ul>
<b>Data analysis and review</b>	Data analysis and review may be performed using enterprise databases and analysis tools
<b>Analysis results</b>	Analysis results may include: <ul style="list-style-type: none"> <li>• in-service failure mode effects and criticality analysis</li> <li>• corrective maintenance analysis</li> <li>• reliability centred maintenance analysis</li> <li>• maintenance task analysis</li> <li>• repair level analysis</li> </ul>
<b>LORA</b>	LORA refers to an analytical methodology used to assist in the development of maintenance concepts and to establish the maintenance level at which components will be repaired, replaced or discarded on the basis of constraints (economic or other) and readiness requirements
<b>A technical data management system</b>	A technical data management system should provide for: <ul style="list-style-type: none"> <li>• maintenance of all applicable technical data</li> <li>• retention of original and back-up data in separate locations</li> <li>• storage in a manner that minimises the risk of data loss, theft or destruction</li> </ul>
<b>The relevance of technical data</b>	The relevance of technical data may be determined through: <ul style="list-style-type: none"> <li>• monitoring engineering, maintenance and supply support activities</li> <li>• utilising user feedback</li> </ul>
<b>ILS standards and references</b>	ILS standards and references include: <ul style="list-style-type: none"> <li>• Army Regulation 700-127 Integrated Logistic</li> </ul>

	<p>Support</p> <ul style="list-style-type: none"><li>• Defence Standard 00-600 Integrated Logistic Support for MOD Projects</li><li>• Defence Standard 00-40 Reliability and Maintainability Pt 1</li><li>• Defence Standard 00-41 Reliability and Maintainability MOD Guide to Practices and Procedures</li><li>• MIL-STD 1390D Level of Repair Analysis</li><li>• NAVAIR 00 -25 403 Guidelines for the Naval Aviation Reliability-Centred Maintenance Process</li><li>• Integrated Logistic Support Handbook, third edition</li><li>• NASA Fault Tree Assessment Handbook</li></ul>
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## Unit Sector(s)

### Competency field

Unit sector            Engineering science

## Custom Content Section

Not applicable.

# **MEM234038A Apply systems engineering procedures to engineering design project management**

## **Modification History**

Release 1 (MEM05v9)

## **Unit Descriptor**

This unit of competency covers the application of systems engineering procedures in the management of complex engineering design projects, in particular where extensive integration of subsystems and components is required. The system hardware, architecture and software design aspects of systems engineering are covered in specialist design units of competency which all include a requirement for the application of systems thinking.

## **Application of the Unit**

Systems engineering procedures are applied in setting up management procedures for engineering design projects involving the design of complex systems that require the integration of subsystems and/or components by a multi-discipline engineering team. The management processes may relate to all design stages and may include the development of systems software. In the production and life cycle management stages, systems engineering design stage output data may be used in the application of configuration management (CM) procedures (refer to MEM234036A Apply configuration management procedures in engineering project management) and/or to support the application of integrated logistic support (ILS) (refer to MEM234037A Perform maintenance-related integrated logistic support management activities) where justified by system size and complexity or where required by contract.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Analyse and document system requirements   | 1.1 Identify and document customer or contractual system requirements                      |
|   |  | 1.2 Set up a systems engineering team and allocate responsibilities                        |
|   |  | 1.3 Analyse system requirements and define functional requirements and design constraints  |
| 2 | Perform functional analysis and allocation | 2.1 Decompose system functions to lower level functions applicable to system design        |
|   |  | 2.2 Allocate design constraints to all functional levels                                   |
|   |  | 2.3 Define and refine internal and external functional interfaces                          |
|   |  | 2.4 Define, refine and integrate functional architecture                                   |
|   |  | 2.5 Review functional analysis outcomes against requirements and revise, where necessary   |
|   |  | 2.6 Develop and document the functional baseline   |
| 3 | Manage preliminary design activities       | 3.1 Coordinate the development of performance specifications for the system and components |
|   |  | 3.2 Define alternatives for system concepts, components and system elements                |
|   |  | 3.3 Select preferred product and process solutions   |
|   |  | 3.4 Define and refine internal and external physical interfaces                            |

- 3.5 Define and refine system software requirements
  - 3.6 Develop and document the allocated baseline
- 4 Manage the detail design activities
  - 4.1 Coordinate the development of item, process and material specifications
  - 4.2 Coordinate the development of software specifications
  - 4.3 Coordinate the development of engineering drawings and associated material/component/hardware lists
  - 4.4 Coordinate the development of item performance specifications
  - 4.5 Determine product review and design verification procedures
  - 4.6 Develop and document the product baseline
- 5 Provide oversight of production and delivery
  - 5.1 Apply product review and verification procedures and initiate action to remedy design or production deficiencies
  - 5.2 Ensure that all relevant regulatory requirements are being met
- 6 Provide for life cycle management of the system, components and software
  - 6.1 Where there is a contractual requirement for application of CM, provide the technical data package and define the configuration items (CIs) and baselines
  - 6.2 Where there is a contractual requirement for ILS, provide the technical data package and data required for the development of the relevant ILS plans
  - 6.3 Where there are no contractual requirements regarding life cycle management, deliver the technical data package and develop procedures for the management of the configuration of the system, system components and software

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- setting up and managing procedures for systems analysis and control
- setting up and managing a systems engineering team
- developing and implementing procedures for identification of systems engineering process inputs
- managing and recording the outcomes of requirements analysis
- managing and recording the outcomes of functional analysis and allocation and applying the requirements loop process
- developing and documenting the functional baseline
- managing the development of the system specification and preliminary design
- developing and documenting the allocated baseline
- applying the design loop process
- managing the detail design process and using outputs to develop a technical data package
- developing and documenting the product baseline
- maintaining oversight of the production and delivery phase
- providing process outputs for the establishment of CM procedures or ILS plans
- determining requirements for life cycle management where CM or ILS is not required and setting up and documenting the life cycle management system

### Required knowledge

Required knowledge includes:

- the systems engineering process and management procedures
- how to set up and manage the activities of a systems engineering design team
- development of specifications and standards
- identification of applicable published specifications and standards
- how to set up and manage a systems analysis and control database
- how to use process outputs to set up CM and ILS systems for through-life management
- how to develop and document an applicable life cycle management system where CM or ILS is not prescribed or is inappropriate
- ethical considerations in systems engineering

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in managing the application of the systems engineering process.</p>
<p><b>Context of and specific resources for assessment</b></p>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations.</li> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<p><b>Method of assessment</b></p>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>



<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Systems engineering process management</b>	The systems engineering process is a comprehensive process for the design and integration of complex systems that cover a range of engineering disciplines. The actual design work will be performed by appropriately qualified specialist engineers and the management process ensures that the design activities are coordinated and integrated into a system that meets specified performance requirements
<b>System requirements analysis</b>	System requirements analysis involves inputs such as customer needs and objectives, regulatory requirements and the technology base. It must clarify and define functional requirements and design constraints
<b>Functional analysis and allocation</b>	Functional analysis and allocation provides a greater understanding of what the system has to do and allocates overall system performance requirements to lower level subsystem and component functions. In so doing, it provides information essential to optimising physical solutions
<b>Baselines</b>	The functional, allocated and product baselines document a product at a specific stage of design definition. The functional baseline describes system level requirements, the allocated baseline describes design requirements for items below systems level and the product baseline describes the product physical detail
<b>Technical data package</b>	Technical data packages may include: <ul style="list-style-type: none"><li>• engineering drawings and associated lists</li><li>• technical manuals</li><li>• manufacturing part programs</li></ul>

	<ul style="list-style-type: none"><li>• verification provisions</li><li>• spares provisioning lists</li><li>• specifications developed for the system and system components</li><li>• specifications and standards from international and national bodies (government and non-government)</li><li>• relevant regulatory standards and requirements</li></ul>
<b>Reference material</b>	<p>Reference material includes:</p> <ul style="list-style-type: none"><li>• System Engineering Fundamentals, Dept of Defence Systems Management College</li><li>• NASA/SP-2007-6105 Rev 1 NASA Systems Engineering Handbook</li><li>• Project Documentation Document SPEC-0064 Rev A, ATST System Engineering Plan</li><li>• 7th Annual Conference on Systems Engineering Research 2009 (CSER 2009), Systems Thinking or Systems Engineering</li></ul>

## Unit Sector(s)

### Competency field

**Unit sector**          Engineering science

## Custom Content Section

Not applicable.

## MEM24001B Perform basic penetrant testing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic penetrant testing procedures in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to basic penetrant testing techniques on fabrications, structures and components across a wide range of industries and restricted to basic visible dye and/or process penetrant line methods.</p> <p>The work can relate to scheduled and unscheduled maintenance activities, using general tools, specific penetrant testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components and structures.</p> <p>Penetrant testing is performed on critical component or structural zones.</p> <p>All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - must be subject to safe work habits and must be stored and used in accordance with safe work practices.</p> <p>This unit should not be selected when Unit MEM24002B</p>
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	<p>(Perform penetrant testing) has already been selected.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for basic penetrant testing	1.1. Inspection areas are cleaned and prepared for testing using appropriate procedures and materials. 1.2. Preparation processes are carried out in accordance with the relevant procedures and OH&S requirements. 1.3. Inspection areas are visually assessed and obvious discontinuities are identified.
2. Perform basic penetrant testing	2.1. Nominated test is identified from standard operating procedures. 2.2. Test equipment is prepared in accordance with standard operating procedures. 2.3. Test media is selected and applied in accordance with workplace practices and specifications. 2.4. Penetrant test is carried out in accordance with relevant work instructions and OH&S requirements. 2.5. Penetrant testing equipment is maintained and stored in accordance with standard operating procedures and OH&S requirements.
3. Report the results of penetrant test(s)	3.1. Basic indications are checked and defects are identified in accordance with enterprise standards and/or procedures. 3.2. Basic indications are confirmed in accordance with enterprise standards and/or procedures. 3.3. Test results are reported in accordance with enterprise standards and/or procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- preparing inspection areas
- identifying discontinuities
- applying procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- applying test media
- applying principles of penetrant testing techniques
- identifying defects
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures.
- following oral instructions
- entering routine and familiar information onto proformas and standard workplace forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- cleaning and preparation processes
- precleaning methods and their areas of use - solvents, vapour degrease, etching, detergents, paint removers, mechanical methods
- consequences of incorrect preparation
- procedures and OH&S requirements in relation to the preparation process
- basic concepts and principles of NDT; general terms, purpose of NDT and areas of application of NDT
- scope and basic description of test
- general properties of penetrants - penetrability, removability, visibility
- emulsifier types
- developer types
- use of standard test panels
- established inspection procedures and techniques
- types of discontinuities and their consequences
- procedure for carrying out penetrant testing
- penetrant application
- dwell times
- penetrant removal
- developer application
- dry powder
- development time
- factors affecting indications
- non-relevant indications
- post-cleaning methods and their areas of use
- basic maintenance and storage procedures for testing equipment
- OH&S requirements including storage requirements
- definition of a defect and common basic defects
- methods/procedures for reporting test results

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform basic penetrant testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic penetrant testing or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures,

<b>EVIDENCE GUIDE</b>	
	product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Preparation processes</b>	Surface cleaning and drying
<b>Obvious discontinuities</b>	Observed changes in material homogeneity
<b>Reported</b>	Accurate identification of location and size of discontinuities

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



## Competency field

Competency field	Non-destructive testing
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## MEM24002B Perform penetrant testing

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing penetrant testing in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to penetrant testing techniques on fabrications, structures and components across a wide range of industries to Level 2 (AS 3669 and AS 3998) or equivalent by portable penetrant testing, processing on a dedicated penetrant line, visible dye and fluorescent methods.</p> <p>The work can relate to scheduled and unscheduled maintenance activities using general tools and specific penetrant testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components, structures and/or aircraft components. Penetrant tests are performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian Standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712. Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p>
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	<p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for penetrant testing	<p>1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials.</p> <p>1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&amp;S requirements.</p> <p>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</p>
2. Perform penetrant testing	<p>2.1. The most appropriate penetrant test for the material/application is selected.</p> <p>2.2. Test equipment is selected and prepared in accordance with standards and/or procedures.</p> <p>2.3. Appropriate test media is selected and applied in accordance with workplace/industry practices.</p> <p>2.4. Penetrant test is carried out in accordance with relevant standards, specifications and OH&amp;S requirements.</p> <p>2.5. Penetrant test equipment is checked for defects, maintained and stored in accordance with procedures, OH&amp;S requirements and manufacturer instructions.</p>
3. Interpret and report the results of penetrant test(s)	<p>3.1. Indications are assessed and defects are detected and classified in accordance with national and international codes and standards.</p> <p>3.2. Defects are confirmed in accordance with enterprise procedures and industry practices.</p> <p>3.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- conducting visual inspections
- identifying discontinuities and defects
- selecting appropriate testing techniques and procedures
- using decision making skills
- assessing risk
- performing measurements needed to meet the requirements of this unit
- entering routine and familiar information onto proformas and standard workplace forms
- locating, reading and interpreting information on written job instructions, specifications, drawings, charts, lists and other reference documentation
- planning, sequencing operations

**Required knowledge**

Look for evidence that confirms knowledge of:

- cleaning and preparation processes for a range of test surfaces
- procedure, statutory and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- types of discontinuities and their consequences/effect on the material
- penetrant testing techniques and procedures for a range of situations
- tools, equipment, techniques
- principles and applications of penetrant testing techniques
- hazards and safety requirements associated with penetrant testing
- maintenance and storage procedures for test equipment
- common faults and damage
- range of defects
- meaning and application of national and international codes and standards
- methods/procedures for reporting test results
- implications of test results for the particular material/application
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform penetrant testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing penetrant testing in a range of industrial applications or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any

**EVIDENCE GUIDE**

	relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preparation processes</b>	Surface cleaning and drying
<b>Obvious discontinuities</b>	Observed changes in material homogeneity
<b>Reported</b>	Accurate identification of location and size of discontinuities

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Non-destructive testing
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## MEM24003B Perform basic magnetic particle testing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic magnetic particle testing procedures in a range of industrial applications. It covers the principles of magnetism and the associated application of basic magnetic particle testing techniques in the field of non-destructive testing. Knowledge of metallurgy associated with the level of application in this unit is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to portable and fixed ('yoke' or 'bench') basic magnetic particle testing techniques on fabrications, structures and components across a wide range of industries.</p> <p>The work can relate to scheduled and unscheduled maintenance activities using general tools and specific magnetic testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are considered, together with ongoing abnormalities in fabrications, components and structures. Magnetic particle testing is performed on critical component or structural zones. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - must be subject to safe work habits and must be stored and used in accordance with safe work practices.</p>
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	<p>This unit should not be selected when Unit MEM24004B (Perform magnetic particle testing) has already been selected.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for basic magnetic particle testing	<p>1.1. Inspection areas are cleaned and prepared for testing using appropriate procedures and materials.</p> <p>1.2. Preparation processes are carried out in accordance with the relevant specifications and OH&amp;S requirements.</p> <p>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</p>
2. Perform basic magnetic particle testing	<p>2.1. Nominated 'yoke' or 'bench' magnetic particle testing procedure is identified from standard operating procedures.</p> <p>2.2. Test equipment is prepared in accordance with relevant standards and/or procedures.</p> <p>2.3. Magnetic particle test is carried out in accordance with relevant work instructions and OHS requirements.</p> <p>2.4. Magnetic particle testing equipment is maintained and stored in accordance with standard operating procedures and OH&amp;S requirements.</p>
3. Report the results of magnetic particle test(s)	<p>3.1. Basic indications are checked and defects are identified in accordance with enterprise standards and/or procedures.</p> <p>3.2. Basic indications are confirmed in accordance with enterprise standards and/or procedures.</p> <p>3.3. Test results are reported in accordance with enterprise standards and/or procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

**REQUIRED SKILLS AND KNOWLEDGE****Required skills**

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques and procedures
- assessing risks
- entering routine and familiar information onto proformas and standard workplace forms
- locating, reading and interpreting information on written job instructions, specifications, charts, lists and other reference documentation
- planning, sequencing operations

**Required knowledge**

Look for evidence that confirms knowledge of:

- surface preparation
- procedures and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- types of discontinuities and their consequences
- scope and basic principles of magnetic particle testing
- procedure for carrying out magnetic particle test using either the 'yoke' or 'bench'
- advantages and limitations of magnetic particle testing
- hazards and safety precautions associated with magnetic particle testing
- basic maintenance and storage procedures for testing equipment
- common basic defects
- methods/procedures for reporting test results
- advantages, limitations of various equipment
- magnetic particle application - methods for wet, dry particles
- recording and reporting results of simple tests
- safety precautions in testing
- use of toxic, flammable materials, electrical hazards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform basic magnetic particle testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic magnetic particle testing procedures in a range of industrial applications or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preparation processes</b>	Surface cleaning and drying
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Non-destructive testing
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## MEM24004B Perform magnetic particle testing

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing magnetic particle testing in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to magnetic particle testing techniques on fabrications, structures and components across a wide range of industries to Level 2 (AS 3669 and AS 3998) or equivalent.</p> <p>The work can relate to scheduled and unscheduled maintenance activities using general tools specific testing equipment as specified in maintenance documentation, testing procedures or operators instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components, structures and/or aircraft components. Magnetic particle testing is performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal and OH&amp;S regulations. Certification against Australian Standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p>
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	<p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for magnetic particle testing	<ul style="list-style-type: none"><li>1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials.</li><li>1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&amp;S requirements.</li><li>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</li></ul>
2. Perform magnetic particle testing	<ul style="list-style-type: none"><li>2.1. The most appropriate magnetic particle test for the material/application is selected.</li><li>2.2. Testing equipment is selected and prepared in accordance with standards and/or procedures.</li><li>2.3. Magnetic particle test is carried out in accordance with relevant standards, specifications and OH&amp;S requirements.</li><li>2.4. Magnetic particle testing equipment is checked for defects, and maintained and stored in accordance with procedures, OH&amp;S requirements and manufacturer instructions.</li></ul>
3. Interpret and report the results of magnetic particle tests	<ul style="list-style-type: none"><li>3.1. Indications are assessed and defects are detected and classified in accordance with national and international codes and standards.</li><li>3.2. Defects are confirmed in accordance with enterprise procedures and industry practices.</li><li>3.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- reading, interpreting and applying relative testing standards
- reading, interpreting and applying relative conformance standards
- assessing risk
- undertaking calculations using formulae
- entering routine and familiar information onto proformas and standard workplace forms

### Required knowledge

Look for evidence that confirms knowledge of:

- cleaning and preparation processes
- procedures and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- types of discontinuities and their consequences
- magnetic particle testing techniques and procedures for a range of situations
- system verification checks necessary to carry out the magnetic particle test
- principles and applications of magnetic particle testing
- advantages and limitations of magnetic particle testing
- hazards and safety precautions associated with magnetic particle testing
- basic maintenance and storage procedures for testing equipment
- types of magnetism;
- magnetic properties
- magnetic materials
- magnetic circuits
- relative permeability of common engineering materials
- magnetic discontinuity, leakage fields
- types of equipment - portable, stationary, automated etc.
- equipment features
- nature and properties of the various types of magnetising current
- current requirements for testing
- media types - advantages and limitations of dry powders and fluid suspensions
- quality control of media, viewing conditions
- disposal procedures
- environment care
- preparation of parts

**REQUIRED SKILLS AND KNOWLEDGE**

- effect of surface coatings on sensitivity
- effect of surface roughness
- dressing of welds
- interpretation of indications
- lighting conditions
- use of magnification
- factors influencing appearance
- spurious indications, false indications
- surface and sub-surface indications
- common basic defects
- methods/procedures for reporting test results
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform magnetic particle testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must

**EVIDENCE GUIDE**

	<p>be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing magnetic particle testing in a range of industrial applications or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Preparation processes**

Surface cleaning and drying

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Non-destructive testing
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## MEM24005B Perform basic eddy current testing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating eddy current testing equipment and performing basic testing procedures in a specific range of industrial applications. Knowledge of metallurgy, electricity, magnetism and electromagnetism associated with the level of application in this unit is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the preparation and performance of eddy current testing on fabrications, structures and components across a wide range of industries. It includes wheel bead seat, production line, tube production line and conductivity measurement methods. The work can relate to scheduled and unscheduled maintenance activities using general tools and specific eddy current testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components and structures. Eddy current testing is performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with relevant standards. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p>
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	<p>This unit should not be selected when Unit MEM24006B (Perform eddy current testing) has already been selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for basic eddy current testing	1.1. Inspection areas are cleaned and prepared for testing using appropriate procedures and materials. 1.2. Preparation processes are carried out in accordance with the relevant procedures and OH&S requirements. 1.3. Inspection areas are visually assessed and obvious discontinuities are identified.
2. Perform basic eddy current testing	2.1. Nominated test is identified from standard operating procedures. 2.2. Test equipment is prepared in accordance with standards and/or procedures. 2.3. Eddy current test procedure is carried out in accordance with relevant work instructions and OH&S requirements. 2.4. Eddy current test equipment is maintained and stored in accordance with standard operating procedures and OH&S requirements.
3. Report the results of basic eddy current test(s)	3.1. Basic indications are checked and defects are identified in accordance with enterprise standards and/or procedures. 3.2. Basic indications are confirmed in accordance with enterprise standards and/or procedures. 3.3. Test results are reported in accordance with enterprise standards and/or procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- documenting and reporting
- assessing risk
- reading and interpreting routine information on written job instructions, specifications and standard operating procedures. May include drawings
- performing calculations using formulae

**Required knowledge**

Look for evidence that confirms knowledge of:

- cleaning and preparation processes
- procedures and OH&S requirements in relation to the preparation process
- visual inspection
- eddy current instrument set-up
- probe selection
- established assessment procedures and techniques
- types of discontinuities and their consequences
- procedure for carrying out basic eddy current testing
- system verification checks necessary to carry out basic eddy current testing
- testing and compliance standards (enterprise specific)
- standard recording and reporting formats
- standard defects and comparative techniques
- basic principles of electricity, magnetism, electromagnetism and eddy current testing
- basic electrical principles
- test principles
- overview of factors affecting eddy current response
- basic metallurgy
- limitations of eddy current testing
- hazards and safety precautions associated with eddy current testing
- basic maintenance and storage procedures for testing equipment
- common basic defects (these are industry-specific and relevant workplace defects should be chosen)
- methods/procedures for reporting test results
- use and application of personal protective equipment

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to perform basic eddy current testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating eddy current testing equipment and applying basic testing procedures in a specific range of industrial applications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be

EVIDENCE GUIDE	
	permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
Guidance information for assessment	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
Preparation processes	Surface cleaning and drying

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Non-destructive testing
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## MEM24006B Perform eddy current testing

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing eddy current testing in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to inspection, interpretation, classification and reporting of results of eddy current testing on fabrications, structures and components across a wide range of industries to Level 2 (AS 3669 and AS 3998) or equivalent. The work can relate to scheduled and unscheduled maintenance activities using general tools and specific testing eddy current testing tools and equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are considered, together with ongoing abnormalities in fabrications, components, structures and/or aircraft components. Eddy current tests are performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p>
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	<p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for eddy current testing	<ul style="list-style-type: none"><li>1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials.</li><li>1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&amp;S requirements.</li><li>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</li></ul>
2. Perform eddy current testing	<ul style="list-style-type: none"><li>2.1. The most appropriate eddy current test for the material/application is selected.</li><li>2.2. Test equipment is selected and prepared in accordance with standards and/or procedures.</li><li>2.3. Eddy current test is carried out in accordance with relevant standards, specifications and OH&amp;S requirements.</li><li>2.4. Eddy current test equipment is checked for defects, and maintained and stored in accordance with procedures, OH&amp;S requirements and manufacturer instructions.</li></ul>
3. Interpret and report the results of eddy current tests	<ul style="list-style-type: none"><li>3.1. Indications are assessed and defects are detected and classified in accordance with national and international codes and standards.</li><li>3.2. Defects are confirmed in accordance with enterprise procedures and industry practices.</li><li>3.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques and procedures
- reading, interpreting and applying relative testing standards
- reading, interpreting and applying relative conformance standards
- using calculations relating to eddy current testing
- assessing risk
- entering routine and familiar information onto proformas and standard workplace forms

### Required knowledge

Look for evidence that confirms knowledge of:

- cleaning and preparation processes
- procedures and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- types of discontinuities and their consequences
- procedure for carrying out eddy current testing
- tools, equipment, techniques and system verification checks necessary to carry out eddy current testing
- basic principles of electricity, magnetism, electromagnetism and eddy current testing:
  - Reactance - field made by eddy current
  - Biot and Savant law - Definition, Practical (right hand) rules
  - Amperes law - Definition, Applications (toroid, infinite coil, flat coil)
  - Lenz law - Definition, Auto-induction factor, Mutual induction factor, Coupling factor
- induced currents - short circuit coil, metallic mass, skin effect, reactance
- cylindrical bars
- theory of eddy currents
- tubes
- geometric defect characterisation
- multiple defects
- characteristics of eddy current probes
- eddy current equipment:
  - transmission
  - reception
  - data presentation

## REQUIRED SKILLS AND KNOWLEDGE

- equipment controls
- types of equipment:
- physical properties of materials
- electrical conductivity
- magnetic permeability
- applications of eddy current testing
- influence of various parameters on eddy current measurement
- defect position and orientation
- compensation
- structure and geometry of test part
- coupling influence
- relative speed
- limitations of eddy current testing
- hazards and safety precautions associated with eddy current testing
- basic maintenance and storage procedures for testing equipment
- common basic defects
- methods/procedures for reporting test results
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform eddy current testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing eddy current testing in a range of industrial applications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Preparation processes</b>	Surface cleaning and drying
<b>Obvious discontinuities</b>	Observed changes in material homogeneity
<b>Defects</b>	Corrosion, metal fatigue, deformation in non-ferrous/ferrous alloys steels, fatigue cracks, stress corrosion cracking, heat damage, metal properties sorting, manufacturing defects, coating thickness measurement etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Non-destructive testing
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## MEM24007B Perform ultrasonic thickness testing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing ultrasonic thickness testing in a range of industrial applications. Knowledge of metallurgy associated with the level of application in this unit is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to inspecting, interpreting and reporting on ultrasonic testing techniques of fabrications, structures and components. Testing is across a wide range of industries and includes identifying abnormalities such as thickness measurement of corrosion, laminations of non-ferrous/ferrous alloys steels, composite materials. The work can relate to scheduled and unscheduled maintenance activities using general tools and specific ultrasonic testing equipment as specified in maintenance documentation, testing procedures or operators instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components and structures on a wide range of applications. Ultrasonic tests are performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products -</p>
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	<p>are subject to safe work habits and must be stored and used in accordance with safe work practices.</p> <p>This unit should not be selected when Unit MEM24008B (Perform ultrasonic testing) has already been selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the
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unit of competency.	required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for ultrasonic thickness testing	<p>1.1. Inspection areas are cleaned and prepared for testing using appropriate procedures and materials.</p> <p>1.2. Preparation processes are carried out in accordance with the relevant procedures and OH&amp;S requirements.</p> <p>1.3. Inspection areas are visually assessed for obvious discontinuities.</p>
2. Perform ultrasonic thickness testing	<p>2.1. Nominated ultrasonic thickness test is identified from standard operating procedures.</p> <p>2.2. Test equipment is prepared in accordance with standard operating procedures.</p> <p>2.3. Ultrasonic tests are carried out in accordance with relevant standards and OH&amp;S requirements.</p> <p>2.4. Ultrasonic test equipment is maintained and stored in accordance with standard operating procedures and OH&amp;S requirements.</p>
3. Report the results of ultrasonic thickness tests	<p>3.1. Basic thicknesses are identified and explained in accordance with enterprise standards and/or procedures.</p> <p>3.2. Basic thicknesses are confirmed in accordance with enterprise standards and/or procedures.</p> <p>3.3. Test results are reported in accordance with enterprise standards and/or procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- performing calculations
- assessing risk
- entering routine and familiar information onto proformas and standard workplace forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- cleaning and preparation processes for a variety of test surfaces
- procedures and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- basic principles of ultrasonic thickness testing
- properties and behaviour of ultrasound
- basic concepts associated with frequency, velocity, wavelength, amplitude
- generation of ultrasound
- types of discontinuities and their consequences
- procedures for carrying out ultrasonic thickness tests
- tools, equipment, techniques and system verification checks necessary to carry out the ultrasonic thickness test
- advantages and limitations of ultrasonic thickness testing
- hazards and safety requirements associated with ultrasonic thickness testing
- basic maintenance and storage procedures for testing equipment
- common basic defects
- indications and thicknesses
- methods/procedures for reporting test results
- ultrasonic thickness testing equipment
- types of displays:
  - a-scan display
  - b-scan display
- types of couplants, desirable characteristics
- straight beam testing method:
- calibration of thickness testing equipment
- frequency
- probe size and shape
- thickness testing



**REQUIRED SKILLS AND KNOWLEDGE**

- plate testing
  - acceptance standards within the scope of this unit
- recording and reporting:
  - job records
  - routine reports
  - codes and standards
- variables affecting test results
- methods of controlling variables
- component variables:
  - size and geometry
  - distance location from entry surface
  - orientation to entry surface
  - reflecting characteristics of back wall
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform ultrasonic thickness testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not

<b>EVIDENCE GUIDE</b>	
	<p>in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing ultrasonic thickness testing in a range of industrial applications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Preparation processes</b>	Surface cleaning and drying

RANGE STATEMENT	
Obvious discontinuities	Observed changes in material homogeneity
Reported	Accurate identification of location and size of discontinuities

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Non-destructive testing
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## MEM24008B Perform ultrasonic testing

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating ultrasonic testing equipment and applying the testing procedure in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to inspecting, interpreting, classifying and reporting on ultrasonic testing techniques of fabrications, structures and components. Testing is across a wide range of industries to Level 2 (AS 3669 and AS 3998) or equivalent and includes identifying abnormalities. The work can relate to scheduled and unscheduled maintenance activities using general tools and specific ultrasonic testing equipment as specified in maintenance documentation, testing procedures or operator instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components and structures on a wide range of applications. Ultrasonic tests are performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p>
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	<p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM18001C	Use hand tools
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for ultrasonic testing	<p>1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials.</p> <p>1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&amp;S requirements.</p> <p>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</p>
2. Perform ultrasonic testing	<p>2.1. The most appropriate ultrasonic test for the material/application is selected.</p> <p>2.2. Testing equipment is selected and prepared in accordance with standards and/or procedures.</p> <p>2.3. Ultrasonic test is carried out in accordance with relevant standards, specifications and OH&amp;S requirements.</p> <p>2.4. Ultrasonic testing equipment is checked for defects, and maintained and stored in accordance with procedures, OH&amp;S requirements and manufacturer instructions.</p>
3. Interpret and report the results of ultrasonic tests	<p>3.1. Indications are assessed and defects are detected and classified in accordance with national and international codes and standards.</p> <p>3.2. Defects are confirmed in accordance with enterprise procedures and industry practices.</p> <p>3.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- analysing test results
- reading, interpreting and applying relative testing standards
- reading, interpreting and applying relative conformance standards
- performing calculations relating to ultrasonic testing
- assessing risk
- entering routine and familiar information onto proformas and standard workplace forms

**Required knowledge**

Look for evidence that confirms knowledge of:

- cleaning and preparation processes for a variety of test surfaces
- procedures and OH&S requirements in relation to the preparation process
- established assessment procedures and techniques
- principles of ultrasonic testing
- variables affecting test selection
- variables affecting test results
- ultrasound - frequency, velocity, wavelength, amplitude
- behaviour of ultrasound at interfaces
- characteristics of ultrasound in materials
- generation of ultrasound
- detection of ultrasound
- the flaw detector
- basic test methods:
  - pulse-echo and transmission methods
  - resonance methods
  - a, b, c, and p scan
  - types of coupling
  - single, dual and two-probe methods
- characteristics and applications associated with probes
- calibration methods
- variables

## REQUIRED SKILLS AND KNOWLEDGE

- contact and immersion test methods
- testing methods and their application
- flaw size evaluation
- interpretation and evaluation:
  - defect types as related to product
  - codes and standards
- recording and reporting:
  - job records
  - routine reports
  - codes and standards
- written procedures:
  - presentation
  - use of standards
- types of discontinuities and their consequences
- procedures for carrying out ultrasonic tests
- tools, equipment, techniques and system verification checks necessary to carry out the ultrasonic test
- advantages and limitations of ultrasonic testing
- hazards and safety requirements associated with ultrasonic thickness testing
- maintenance and storage procedures for testing equipment
- range of defects
- methods/procedures for reporting test results
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform ultrasonic testing. Competency in this unit cannot be claimed until all prerequisites have been



<b>EVIDENCE GUIDE</b>	
	satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating ultrasonic testing equipment and the application of the testing procedure in a range of industrial applications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Preparation processes</b>	Surface cleaning and drying
<b>Obvious discontinuities</b>	Observed changes in material homogeneity
<b>Defects</b>	Corrosion, metal fatigue, deformation in non-ferrous/ferrous alloys steels, composite materials, fatigue cracks, stress corrosion cracking, manufacturing defects, thickness measurement and fit, mechanical and bonded repairs, laminar tearing, welding defects and casting defects and/or aircraft components
<b>Reported</b>	Accurate identification of location and size of discontinuities

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

Competency field	Non-destructive testing
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## MEM24009B Perform basic radiographic testing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing basic radiographic testing procedures in a range of industrial applications. Knowledge of metallurgy associated with the level of application in this unit is required.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to working with ionizing radiation in open or closed sites; on fabrications, structures and components across a wide range of industries. The work can relate to scheduled and unscheduled maintenance activities using general tools and specific radiographic testing equipment as specified in maintenance documentation, testing procedures or operators instructions. All testing must be completed with particular attention to personal and OH&amp;S regulations. Ionizing radiation equipment materials and chemicals, which are subject to codes and regulations, must be stored, used, and transported in accordance with safe work practices. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>This unit should not be selected when Unit MEM24010B (Perform radiographic testing) has already been selected.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 2</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13013B	Work safely with ionizing radiation
	MEM18001C	Use hand tools

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas ready for basic radiographic testing	1.1. Radiographic specimens are cleaned and prepared for testing using appropriate procedures and materials.

ELEMENT	PERFORMANCE CRITERIA
	<p>1.2.Preparation processes are carried out in accordance with the relevant procedures and OH&amp;S requirements.</p> <p>1.3.Inspection areas are visually assessed and obvious discontinuities are identified.</p>
2. Set up radiographic test equipment	<p>2.1.Nominated test is identified from standard operating procedures.</p> <p>2.2.Radiation testing and processing equipment is set up in accordance with standard operating procedures.</p>
3. Carry out basic radiographic tests	<p>3.1.Basic properties of X-rays and gamma rays are identified.</p> <p>3.2.Safety practices and controls for minimising radiation exposure are applied.</p> <p>3.3.Radiographic testing and safety equipment is operated in accordance with relevant work instructions and OH&amp;S requirements.</p> <p>3.4.Films are processed to achieve optimum results.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- calculating and producing optimum quality radiographs
- effectively designing exposure and storage areas
- calculating shielding thicknesses
- reading, interpreting and applying relative testing standards
- reading, interpreting and applying relative conformance standards
- documenting and reporting
- assessing risk

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- cleaning and preparation processes for a range of test surfaces
- cleaning and preparation processes for a range of test surfaces
- assessment procedures and techniques
- types of discontinuities and their consequences/effect on the material
- procedure for carrying out each radiographic test
- principal types of X-ray generators and radioisotopes and their effect on radiographic sensitivity
- tools, equipment, techniques and system verification checks
- relevant standards, regulations and codes
- hazards associated with radiographic testing
- procedures for specialised radiographic applications
- principles of image formation, film and chemical properties and processing techniques
- various types of films and screens, their properties and effects on image quality
- maintenance and storage procedures for test equipment
- common faults and damage
- safety features of radioisotope cameras and X-ray equipment
- production of X-rays and gamma rays
- absorption of ionizing radiation by matter and the biological effects on living
- X-ray equipment
- gamma ray sources
- comparison of X-ray and gamma ray sources on basis of energy and intensity
- shielding thickness
- exposure calculations
- reciprocity law
- preparation and use of exposure charts, radiographic equivalence charts
- exposure techniques
- equipment types
- recording and reporting
- safety aspects
- types of materials
- industrial applications
- set-up procedures
- methods/procedures for reporting test results
- implications of test results for the particular material/application
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards

**REQUIRED SKILLS AND KNOWLEDGE**

- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform basic radiographic testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing basic radiographic testing procedures in a range of industrial applications, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be



**EVIDENCE GUIDE**

	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preparation processes</b>	Surface cleaning and drying
<b>Obvious discontinuities</b>	Observed changes in material homogeneity

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Non-destructive testing
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## MEM24010B Perform radiographic testing

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers operating radiographic testing equipment and applying the testing procedures in a range of industrial applications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to inspecting, interpreting, classifying and reporting on radiographic testing techniques of fabrications, structures and components.</p> <p>Testing is across a wide range of industries to Level 2 (AS 3669 and AS 3998) or equivalent and includes identifying abnormalities such as corrosion, metal fatigue, deformation in non-ferrous/ferrous alloys steels, composite materials, fatigue cracks, stress corrosion cracking, manufacturing defects, thickness measurement and fit, mechanical and bonded repairs, welding defects and casting defects and/or aircraft components.</p> <p>The work can relate to scheduled and un-scheduled maintenance activities using general tools and specific radiographic testing equipment as specified in maintenance documentation, testing procedures or operators instructions.</p> <p>Actual and potential defects are to be considered, together with ongoing abnormalities in fabrications, components and structures on a wide range of applications. Radiographic tests are performed on critical component or structural zones, and may require re-assessment of competency at regular intervals in accordance with Australian standards and/or other relevant standards. All testing must be completed with particular attention to personal and OH&amp;S regulations.</p> <p>Ionizing radiation equipment materials and chemicals, which are subject to codes and regulations, must be stored,</p>
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	<p>used, and transported in accordance with safe work practices. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Where power tools are required, Unit MEM18002B (Use power tools/hand held operations) should also be selected.</p> <p>Where tests require the interpretation of drawings, Unit MEM09002B (Interpret technical drawings) should also be selected.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM13013B	Work safely with ionizing radiation
	MEM18001C	Use hand tools
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare inspection areas for radiographic testing	<p>1.1. Inspection areas are identified, cleaned and prepared for testing using appropriate procedures and materials.</p> <p>1.2. Preparation processes are carried out in accordance with the relevant procedures, statutory and OH&amp;S requirements.</p> <p>1.3. Inspection areas are visually assessed and obvious discontinuities are identified.</p>
2. Select and prepare radiographic test	<p>2.1. The most appropriate radiographic test for the material/application is selected.</p> <p>2.2. Appropriate testing and processing equipment is selected and set up for various geometries in accordance with standards and/or procedures.</p> <p>2.3. Quality of radiographic test is optimised.</p>
3. Perform radiographic testing	<p>3.1. Radiographic tests are carried out in accordance with relevant standards, codes, specifications and OH&amp;S requirements.</p> <p>3.2. Radiographs are set up and carried out for specialised applications.</p> <p>3.3. Films are processed to maximise quality of image.</p> <p>3.4. Films are processed to achieve optimum results.</p>
4. Maintain radiographic testing equipment	<p>4.1. Radiographic testing equipment is checked for defects, maintained and stored in accordance with procedures, OH&amp;S requirements and manufacturer instructions.</p>
5. Monitor and ensure radiation safety	<p>5.1. Safety controls are set up and maintained.</p> <p>5.2. Exposure to radiation employees and general public is minimised.</p> <p>5.3. Radiation monitoring equipment is selected and</p>

ELEMENT	PERFORMANCE CRITERIA
	used.
6. Interpret and report the results of radiographic tests	<p>6.1. Conditions necessary to view and interpret radiographs are established.</p> <p>6.2. Radiographs are interpreted/evaluated in accordance with applicable codes, standards and specifications.</p> <p>6.3. Test results are reported in accordance with enterprise procedures, accepted industry practices and customer service requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting and following procedures
- identifying inspection areas
- identifying discontinuities and defects
- selecting appropriate testing techniques, equipment and procedures
- calculating and producing optimum quality radiographs
- effectively designing exposure and storage areas
- calculating shielding thicknesses
- reading, interpreting and applying relative testing standards
- reading, interpreting and applying relative conformance standards
- documenting and reporting
- assessing risk

#### Required knowledge

Look for evidence that confirms knowledge of:

- cleaning and preparation processes for a range of test surfaces
- cleaning and preparation processes for a range of test surfaces
- assessment procedures and techniques
- types of discontinuities and their consequences/effect on the material
- procedure for carrying out each radiographic test
- principal types of X-ray generators and radioisotopes and their effect on

**REQUIRED SKILLS AND KNOWLEDGE**

- radiographic sensitivity
- tools, equipment, techniques and system verification checks
- relevant standards, regulations and codes
- hazards associated with radiographic testing
- procedures for specialised radiographic applications
- principles of image formation, film and chemical properties and processing techniques
- various types of films and screens, their properties and effects on image quality
- maintenance and storage procedures for test equipment
- common faults and damage
- safety features of radioisotope cameras and X-ray equipment
- production of X-rays and gamma rays
- absorption of ionizing radiation by matter and the biological effects on living
- X-ray equipment
- gamma ray sources
- comparison of X-ray and gamma ray sources on basis of energy and intensity
- shielding thickness
- exposure calculations
- reciprocity law
- preparation and use of exposure charts, radiographic equivalence charts.
- exposure techniques
- equipment types
- recording and reporting
- safety aspects
- types of materials
- industrial applications
- set-up procedures
- methods/procedures for reporting test results
- implications of test results for the particular material/application
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to perform radiographic testing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with operating radiographic testing equipment and applying testing procedures or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.



**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Preparation processes</b>	Surface cleaning and drying
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Non-destructive testing
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## MEM24011B Establish non-destructive tests

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers researching, analysing, developing, approving and evaluating non-destructive tests (NDT).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to research, development, approval and evaluation of applicable non-destructive tests on fabrications, structures and components across a wide range of industries to Level 3 (AS 3669 and AS 3998) or equivalent.</p> <p>The work can relate to scheduled and unscheduled maintenance activities using general tools and specific testing equipment, test development procedures or guidelines. Activities should replicate 'in-service' tasks due to the high level of self-supervision and the critical nature of the work.</p> <p>Actual and potential defects are considered, together with ongoing abnormalities in fabrications, components, structures from a wide range of applications by the selection of relevant testing method. Tests are validated/evaluated on critical component or structural zones. All testing must be developed and completed with particular attention to personal safety and OH&amp;S regulations. Certification against Australian standards may be achieved where assessment in this unit of competency is carried out in conjunction with an examining authority as described in ISO 9712.</p> <p>Materials and chemicals which are subject to codes and regulations - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - are subject to safe work habits and must be stored and used in accordance with safe work practices.</p> <p>This unit should not be selected when Unit MEM05025C</p>
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	(Perform welding fabrication inspection) has already been selected.  <b>Band: B</b> <b>Unit Weight: 12</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13013B	Work safely with ionizing radiation
	MEM16010A	Write reports
	MEM18001C	Use hand tools
	MEM24002B	Perform penetrant testing
	MEM24004B	Perform magnetic particle testing
	MEM24006B	Perform eddy current testing
	MEM24008B	Perform ultrasonic testing
	MEM24010B	Perform radiographic testing
	MEM24012C	Apply metallurgy principles

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess requirements for non-destructive test	<p>1.1. Inspection area is assessed for testing and all possible failure sites are identified utilising metallurgical analysis.</p> <p>1.2. Relevant information for test development is collected from available sources using accepted techniques.</p> <p>1.3. Information is analysed and interpreted.</p> <p>1.4. Test requirements are determined.</p>
2. Establish non-destructive test techniques and procedures	<p>2.1. Test methods, techniques and procedures to be used for specific NDT work are designated.</p> <p>2.2. Codes, standards, specifications and procedures are interpreted.</p> <p>2.3. Test procedures are developed in accordance with established techniques and metallurgical principles.</p>
3. Validate/confirm non-destructive tests	<p>3.1. General and specific test procedures are validated in accordance with established techniques.</p> <p>3.2. Inspection results are interpreted and evaluated in terms of existing codes, standards and specifications.</p>
4. Approve non-destructive test procedures	<p>4.1. Procedures are approved in accordance with workplace procedures and relevant codes and standards.</p> <p>4.2. Procedures are documented and distributed in accordance with workplace requirements and relevant codes and standards.</p>
5. Evaluate non-destructive test procedures	<p>5.1. Procedures are evaluated for effectiveness.</p> <p>5.2. Evaluation results are documented and reported according to workplace requirements.</p> <p>5.3. Changes/amendments to non-destructive test</p>

ELEMENT	PERFORMANCE CRITERIA
	procedures are made and distributed as necessary.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- conducting metallurgical assessment of inspection areas
- designating most appropriate method, technique or procedure
- referencing information
- developing and validating test procedures
- applying safety procedures, standard operating procedures and legislative requirements to all work
- reading/interpreting/applying relative testing standards
- reading/interpreting/applying relative conformance standards
- documenting procedure and results

#### Required knowledge

Look for evidence that confirms knowledge of:

- application of metallurgical analysis to assess inspection areas
- NDT methods, techniques and procedures
- meaning and validity of relevant codes, standards, specifications and procedures
- test procedure for testing techniques and specimen
- validation processes
- process for approval of procedures
- process for documentation/distribution of procedures
- evaluation procedures
- process for documentation of evaluation results
- process for amending tests and distributing amendments
- any applicable industry standards, national/Australian standards, NOHSC guides, State/Territory regulatory codes of practice/standards
- use and application of personal protective equipment
- safe work practices and procedures
- relevant hazards and control measures related to the competency

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to establish non-destructive tests. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with the research, analysis, development, approval and evaluation of non-destructive tests, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and

<b>EVIDENCE GUIDE</b>	
	documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Non-destructive testing
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## MEM24012C Apply metallurgy principles

### Modification History

Single band identifier removed to clarify dual status

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying basic metallurgy principles related to selecting appropriate non-destructive testing techniques (NDT) and interpreting the results of NDT tests for metallurgical processes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to knowledge of metallurgy principles, and the relationship between the various non-destructive testing methods and their capabilities and limitations when applied to the detection of specific discontinuities in metals and alloys.</p> <p>The unit applies to employees other than NDT technicians such as metallurgists, welding supervisors etc. who select and order NDT tests and who interpret results provided by tests for metal manufacturing, casting, shaping, and joining processes. The unit does not apply to the conduct of NDT tests.</p> <p>Such variables as the type of discontinuity, manufacturing process and limitations will assist in determining the sequence of testing and the ultimate selection of one non-destructive test method in preference to another. Any testing that may be carried out must be completed with particular attention to personal and OH&amp;S regulations.</p> <p>Where materials and chemicals which are subject to codes and regulations are stored and used - for example, chemicals, explosives, solvents, dangerous materials, acids, or noxious waste products - safe work habits must be considered.</p> <p><b>Band:</b></p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit</p>
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	for progression to C5 (AQF level V).
	<b>Unit Weight: 4</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
1. Interpret and apply the principles of solidification and crystal structures in metals and alloys	1.1.Principles of solidification and crystal structures in metals and alloys are interpreted and applied in relation to NDT techniques.
2. Interpret equilibrium diagrams for metals and alloys	2.1.Equilibrium diagram for metal or alloy is correctly sourced 2.2.Equilibrium diagrams are correctly interpreted.
3. Interpret and apply the principles of fusion welding of metals and alloys	3.1.Principles and methods for fusion welding of metals and alloys are applied to NDT test selection. 3.2.Defects in weldments are identified and classified from NDT test results.
4. Interpret and apply the principles of the formation of castings	4.1.Principles and methods used to produce metal castings are applied to NDT test selection. 4.2.Defects in metal and alloy castings are identified and classified from NDT test results.
5. Interpret and apply the principles of steel forging	5.1.Principles and methods used to produce steel forgings are applied to NDT test selection. 5.2.Defects in steel forgings are identified and classified from NDT test results.
6. Interpret and apply the principles of mechanical testing	6.1.Principles of mechanical testing are applied to NDT test selection. 6.2.Defects in metal product are identified and classified from NDT test results

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- research
- understanding and applying metallurgy principles
- selecting NDT test appropriate to metal or alloy and manufacturing process

**REQUIRED SKILLS AND KNOWLEDGE****Required knowledge**

Look for evidence that confirms knowledge of:

- principles of solidification and crystal structures in metal:
  - classification of materials
  - structure of atoms
  - process of solidification
  - crystal structures
  - defects formed during solidification
  - modification of crystal structure
  - heat treatment processes
  - defects formed during heat treatment
- meaning of equilibrium diagrams representative of a range of metals including aluminium, iron, steel and common non-ferrous alloys:
  - alloy systems
  - solid and liquid solubility
  - basic equilibrium diagrams
  - equilibrium diagrams for common alloys
- principles of fusion welding in relation to NDT testing
- defects in fusion welding:
  - processing defects
  - grinding cracks
  - pickling cracks
  - heat treatment cracks
  - service defects
  - fatigue cracks
  - corrosion and stress corrosion cracks
- principles of the formation of castings
- defects in castings
- principles of steel forging
- defects in steel forging
- principles of mechanical testing:
  - mechanical testing
  - tensile testing
  - impact testing
  - hardness testing
  - fatigue testing
- other tests

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply metallurgy principles to NDT test selection and interpretation. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic metallurgy principles as related to non-destructive testing techniques, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate

<b>EVIDENCE GUIDE</b>	
	must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Principles and methods for fusion welding of metals and alloys</b>	<ul style="list-style-type: none"> <li>• MMAW</li> <li>• SAW</li> <li>• GMAW</li> <li>• GTAW</li> <li>• FCAW</li> </ul>
<b>Defects in weldments</b>	Cracks, lack of fusion, cavities, imperfect shape, solid inclusions, miscellaneous
<b>Defects in metal and alloy castings</b>	Shrinkage cavities, hot tears, cold cracks, gas holes
<b>Principles and methods used to produce steel forgings</b>	Deformations, strengthening mechanisms, annealing
<b>Principles of mechanical testing</b>	Impact, tensile, hardness testing

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Non-destructive testing
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## MEM25001B Apply fibre-reinforced materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying and forming/shaping fibre-reinforced materials. It covers the use of manual and mechanical methods using a variety of glass reinforcements and other fibres. Typical applications include marine vessel and aircraft construction.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to application and forming operations conducted within a mould or over a former assembly. Tasks may include hand and mechanical lay-up practices and sheathing applications. Typical applications may include hull, deck, superstructures, bulkhead and partitions, transverse and longitudinal frame members, engine beds and tanks.</p> <p>Materials may include a variety of glass reinforcements and other fibres, types of laminating resins, stiffening materials such as foams, core mat etc.</p> <p>Tools and equipment may include appropriate brushes and rollers, metal rollers, gel coat and resin depositors.</p> <p>Forming and integration work and vacuum bagging techniques are covered by Unit MEM25002B (Form and integrate fibre-reinforced structures).</p> <p>This unit should not be selected if Unit MEM25002B (Form and integrate fibre-reinforced structures) has already been selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for application/forming	1.1.Appropriate tools and equipment are selected according to organisational requirements and

ELEMENT	PERFORMANCE CRITERIA
operations	<p>instructions.</p> <p>1.2. Equipment is set up and adjusted ready for operation, in accordance with standard operating procedures.</p> <p>1.3. Required specifications are identified.</p> <p>1.4. Materials are selected according to job specifications.</p> <p>1.5. Allowances for thickness to specifications are made.</p>
2. Apply reinforced materials	<p>2.1. Components are positioned ready for reinforcement operation.</p> <p>2.2. Equipment is started up, shut down and operated according to standard operating procedures.</p> <p>2.3. Safe working practices are followed, including the use of personal protective equipment.</p>
3. Form and shape reinforcement materials	<p>3.1. Materials are rolled/shaped to specified thicknesses and/or finishes.</p> <p>3.2. Materials are laminated according to specifications.</p> <p>3.3. Final application and shape is checked for compliance to specifications and adjusted as necessary.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting equipment for the application/forming job
- checking equipment for correct operation
- setting up and operating/adjusting equipment
- interpreting and clarifying work instructions
- selecting materials to suit different operations
- making allowances to suit conditions and specifications
- positioning components
- following operating procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- working safely
- using personal protective equipment (PPE)
- rolling/shaping material
- smoothing irregularities
- laminating
- ensuring compliance to specification

**Required knowledge**

Look for evidence that confirms knowledge of:

- tools and equipment for application/forming operations
- procedures for setting up and adjusting equipment
- terminology and information relevant to standard work instructions
- applicable codes and regulations
- different chemicals and materials and their properties, including mixing ratios
- the importance and relevance of thickness allowances
- techniques for positioning components
- safety requirements and start up/shut down/operating procedures
- safe working practices and safe use of personal protective equipment
- methods for rolling and shaping
- problems associated with rolling and shaping and methods for rectifying
- the lamination sequence
- methods of checking final application and form
- cleaning procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to apply fibre-reinforced materials. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the

<b>EVIDENCE GUIDE</b>	
<b>competency in this unit</b>	unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying fibre-reinforced materials, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised

**RANGE STATEMENT**

wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Appropriate**

Tools and equipment may include appropriate brushes and rollers, metal rollers, gel coat and resin depositors

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Marine craft construction

## MEM25002B Form and integrate fibre-reinforced structures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying, forming and integrating fibre-reinforced components. It covers the use of manual and mechanical methods using a variety of glass reinforcements and other fibres. Typical applications include marine vessel and aircraft construction.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to component construction carried out for mould installation, and application and forming operations conducted within a mould or over a former assembly. Typical applications may include hand and mechanical lay-up practices, post curing practices, core materials for stiffening application, sheathing applications using resins, adhesives, sealants and fillers, and vacuum bagging techniques where applicable.</p> <p>Product/components constructed may include hull, deck, superstructures, bulkhead and partitions, transverse and longitudinal framing, engine beds and tanks etc. Materials may include a variety of glass reinforcements and other fibres, types of laminating resins, other types of stiffening materials such as foams, core mat etc.</p> <p>Tools and equipment used for laminating work may include brushes and rollers, metal roller, gel coat and resin depositors and vacuum bagging equipment. A variety of hand and power tools and workshop machinery can be used for component construction and installation practices.</p> <p>Where mark off/out skills are required, then Unit MEM12007D (Mark off/out structural fabrications and shapes) should also be selected.</p> <p>For straightforward application of fibre-reinforced materials where no forming or integrating is required, Unit MEM25001B (Apply fibre-reinforced materials) should be</p>
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	regarded as sufficient.
	<b>Band: A</b>
	<b>Unit Weight: 4</b>

## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Form components	1.1.Relevant materials for component construction are selected. 1.2.Relevant drawings and templates are selected. 1.3.Components are formed to specifications 1.4.Component sizing matches the appropriate template.
2. Integrate components	2.1.Integration requirements, materials fixing/bonding methods and mixing practices are determined from job specifications and manufacturer specifications. 2.2.Equipment is set up and adjusted according to standard operating procedures. 2.3.Components are fixed/bonded in accordance with job requirements and specifications. 2.4.Reinforcement materials are formed/shaped to specifications. 2.5.Component is prepared for encapsulation process.
3. Undertake post-curing of materials	3.1.Post-curing method is selected to suit job application. 3.2.Equipment/accessories for post-curing are set up. 3.3.Equipment/accessories are stored according to standard procedure.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting and gathering laminating resins, fibre reinforces, core materials, resins, hardeners, releasing agents, pigments, fillers
- identifying and interpreting drawings/templates for construction process
- selecting and using hand tools, power tools, workshop equipment and machinery
- checking component dimensions for compliance against templates, drawings and specifications
- selecting and mixing fixing/bonding materials
- setting and adjusting equipment such as resin/roving depositor gun, vacuum

**REQUIRED SKILLS AND KNOWLEDGE**

bagging equipment

- selecting adhesive/filler materials and applying fixing/bonding methods for component integration
- cutting and shaping/bevelling foams, timber/plywood reinforcements to specification
- cleaning excess fixing/bondage material
- using personal protective equipment (PPE)
- working safely
- disposing of waste in accordance with legislation
- selecting post-curing methods
- following operational procedures/safety requirements
- disassembling, cleaning and storing equipment/accessories

**Required knowledge**

Look for evidence that confirms knowledge of:

- typical components, fibre reinforcement and core materials, resins and hardeners, fillers, release agents, pigment additives, their attributes and their uses
- chemical and physical properties of resins, mixing ratios, laminate thicknesses, strengths and curing properties
- drawings and templates and their construction role
- applicable codes and regulations
- hand tools, power tools, workshop equipment and machinery and their use
- personal protective equipment and safety practices
- waste disposal obligations and regulations
- method used to check component dimensions against drawings, templates and specifications
- procedures used to install component, fixing/bondage and mixing application
- methods of component integration
- procedures required in setting up and adjusting equipment
- relevant adhesive/filler and fixing/bonding methods
- procedures for forming/shaping and tools/machinery used
- importance of cleaning excess fixing/bondage material
- post-curing methods, procedures and applications
- storage procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to form and integrate fibre-reinforced structures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with forming and integrating fibre-reinforced structures, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for  
assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)****Unit sector**

## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Marine craft construction
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## MEM25003B Set up marine vessel structures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up marine vessel structures. It includes straightforward levelling and alignment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to work undertaken individually or as part of team environment.</p> <p>Structures include composite, metal and timber requiring a location/erection process. Structures would typically be those where fairness and load bearing is critical and/or where building/marine regulations may apply. Specifications for the structure would be supplied via engineering drawings or similar and include site location information. Structures would include framework such as hull framing, deck framing, superstructures, jig construction, stairways, walkways, tanks, platforms, cradles etc. completed prior to commencement of installation work.</p> <p>Levelling and alignment undertaken would be of a straightforward nature, which may include plumb bob/lines, spirit levels, water and dumpy levels etc. This unit does not include fixed structures, such as jetties, wharves, moorings etc.</p> <p>Materials include timber and other non-metallic materials.</p> <p>Where erection of metal structures is required, Unit MEM10001C (Erect structures) should be selected.</p> <p>Where construction and assembly of entirely marine timber components is undertaken, Unit MEM25005B (Construct and assemble marine timber components) should be selected.</p> <p>Where lifting or rigging skills are required, appropriate</p>
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	materials handling units should be accessed.  <b>Band: A</b> <b>Unit Weight: 4</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare site	1.1.The site is checked for location, dimensions and levels in accordance with industry standards. 1.2.Minor alterations, corrections or adjustments are undertaken with approval of appropriate authority. 1.3.Surfaces and materials/components are prepared for use. 1.4.Structural components and materials are identified.
2. Undertake levelling and measurement readings	2.1.Principles of levelling and measurement reading are applied. 2.2.Task requirements are determined. 2.3.Levelling procedures are identified. 2.4.Levelling equipment is selected and set up to operating procedures. 2.5.Levelling measurements are taken accurately. 2.6.Levelling tasks are completed to specifications.
3. Erect marine vessel structures	3.1.All work is carried out safely and in accordance with defined procedures. 3.2.Components of structure are prepared correctly for sequential erection. 3.3.Components are erected and fixed according to specifications. 3.4.Structure alignment meets required specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:



## REQUIRED SKILLS AND KNOWLEDGE

- checking construction site location, dimension and levelling
- effecting minor alterations, corrections or adjustments
- identifying and confirming relative structural components and material species against job specification
- selecting and using levelling and measurement tools/methods
- taking measurements
- applying engineering principles and techniques
- using tools and measuring equipment
- interpreting specifications, establishing alignment requirements and achieving levelled structures
- identifying safe working requirements
- making adjustments to achieve correct specifications

## Required knowledge

Look for evidence that confirms knowledge of:

- practices used for checking construction site location, dimensions and levelling procedures
- procedures for effecting authorised minor alterations, correction or adjustment
- practices used to prepare surfaces, materials/component structures
- structural components and material species/types in accordance with job specifications
- process for obtaining levelling and measurement reading
- levelling and measurement tools/methods
- levelling method used to level equipment/component assembly structure
- levelling equipment and set-up procedure
- engineering principles, techniques, tools and equipment for levelling and measurement
- personal protective equipment and safe working practices
- safety principles for erecting structures
- sequence of assembly of component structure
- erecting and fixing methods

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to set up marine vessel structures in readiness for fixing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting up marine vessel structures, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Appropriate authority</b>	Appropriate authority may be a supervisor, customer, surveying agency, etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Marine craft construction
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## MEM25004B Fair and shape surfaces

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers filling, sanding, fairing and grinding to achieve uniform or correct contours and surfaces. Typical applications include marine vessel construction and the manufacture of transport vehicles.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to filling, sanding, fairing and grinding practices to achieve uniform or correct contours and surfaces, typically on marine vessels and other transport vehicles.</p> <p>Work would be undertaken autonomously and to predetermined standards of quality and safety, and to standard operational procedures.</p> <p>Typical construction materials may include timber, fibre-reinforced materials and metal materials of new and pre-coated surface area. A variety of fillers and abrasive materials of different grades would be used to suit job application.</p> <p>A selection of hand and power tools may include electric or pneumatic disc, orbital and belt sanders, 'torture-boards', straight and angle grinders. Die grinders may be used for certain applications but should not be used as the sole tool for assessment purposes.</p> <p>Where slipping is required, or when working on a slipped craft, Unit MEM25014B (Perform marine slipping operations) should also be selected.</p> <p>Relevant units related to specific applications and materials should also be selected as required.</p> <p><b>Band: A</b></p>
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	<b>Unit Weight: 2</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine requirements for operation	1.1.Job requirements are identified. 1.2.Sequence of operations is determined.
2. Prepare for filling/sanding/grinding operations	2.1.Safety equipment is set up in accordance with standard procedure. 2.2.Appropriate fillers and abrasive materials are selected and prepared to suit job requirements and required surface finish. 2.3.Appropriate equipment and accessories are selected and set up ready for operation.
3. Perform filling, sanding, fairing and grinding operations	3.1.Work is carried out to specified finishes. 3.2.Power tools are used to optimise equipment and material use. 3.3.Safety procedures are observed, safety glasses/shield worn and, where applicable, protective clothing is worn. 3.4.Surfaces are checked to ensure compliance to specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining and applying job requirements
- identifying and selecting materials to be prepared
- filling/sanding/grinding, fairing and shaping to requirements
- setting up and using safety equipment such as fans, extraction unit
- preparing fillers and abrasive materials
- setting up and using sanding/grinding, power tools such as disc sander, angle grinder and associated safety accessories such as dust extraction assemblies and guard protection
- surface filling, sanding, internal and external sanding to achieve flat, concave and convex surfaces

**REQUIRED SKILLS AND KNOWLEDGE**

- using personal safety protection
- checking surface and finish visually and by use of fairing battens, straightedges, stringlines, french curves, templates etc.

**Required knowledge**

Look for evidence that confirms knowledge of:

- filling and fairing specifications
- types, properties and characteristics of fillers and materials to be prepared and features/specific preparation requirements
- filler ingredient measuring and preparation techniques
- relevant safety equipment and uses/application
- filling, fairing and shaping techniques
- equipment and accessories and applications
- means of optimising life of abrasive materials and reducing waste
- personal safety procedures and protective equipment relevant to sanding/grinding practices
- safety hazards and hazard reduction relating to faired materials, fillers and abrasives
- compliance testing procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to fair and shape surfaces. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for**

This unit may be assessed on the job, off the job or a

**EVIDENCE GUIDE****assessment**

combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fairing and shaping surfaces, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.



**RANGE STATEMENT**


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Marine craft construction
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## MEM25005B Construct and assemble marine vessel timber components

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers constructing and assembling marine timber components, including laminating by cold processes.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to marine vessel backbone components such as keel, deadwoods, stem etc., transverse and longitudinal framing, knees, deck framing, hull construction, laid deck construction and superstructures.</p> <p>Where hull is to be planked, planking may include but is not limited to carvel, strip, clinker, double diagonal systems. Fastenings, joining methods and sealing systems may vary according to application.</p> <p>Timber joinery must be appropriate for application and fixed to industry standards. This unit includes laminating by cold processes.</p> <p>A variety of hand and hand held power tools and workshop equipment such as bandsaw, surfacer and thicknesser etc. may be used for the construction and assembly practices.</p> <p>Where permanent timber bending practices are required, such as boiling/steam bending, Unit MEM25009C (Form timber shapes using hot processes) should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1.Required information is determined from drawings, instructions and specifications. 1.2.Construction process is selected to suit job application.
2. Construct marine vessel timber components	2.1.Appropriate tools/equipment are selected to suit job application. 2.2.Template/measurement is selected to suit component construction. 2.3.Material is dressed, sized and shaped to suit job requirements and specifications. 2.4.Final form/shape of component is checked against template/measurement specification and modified if necessary. 2.5.Component identification and set-up markings are applied.
3. Assemble components	3.1.Jig support assembly is set up to suit job requirements. 3.2.Materials for fastening, joining and sealing are selected and used according to job specifications and requirements. 3.3.Assembly and fastening sequence is determined. 3.4.Material preservation requirements are carried out, if required. 3.5.Components are assembled to specified line markings and positions. 3.6.Assembled component meets specifications. 3.7.Component assembly is cleaned/prepared to suit job requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- interpreting specifications, drawings, instructions and procedures
- identifying job structure, templates, material types, construction detail and assembly practices
- using tools and equipment
- selecting and using templates for construction
- cutting, sizing, preparing and forming timber
- checking final form/shape of component
- assembling support jigs
- positioning and assembling components
- selecting and using fastening methods
- finishing and applying preservation materials
- cleaning excess material wastage
- undertaking waste disposal in accordance with legislative requirements

**Required knowledge**

Look for evidence that confirms knowledge of:

- component types/materials/templates and their uses
- characteristics, properties, specifications and uses of species, including durability, strength and appearance
- types, specification and uses of fasteners
- applicable codes and regulations
- methods used to take off measurements, mark out, construct and assemble components
- effect on access, rigidity, strength, buoyancy and resistance to stresses encountered at sea
- hand tools, power tools and workshop machinery to suit construction applications
- practices for cutting/dressing/sizing/shaping material
- measuring and marking out techniques using graduated devices, battens, templates, etc.
- procedures used in checking final form/shape
- clamping and shoring methods and the use of jigs
- procedures, codes and regulations used in applying relevant fastenings to suit assembly
- methods of cleaning, preserving and finishing components, their uses and safety precautions
- waste disposal obligations and regulations

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to construct and assemble marine vessel timber components. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with constructing and assembling marine vessel timber components or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to tools, equipment, materials and documentation required and must be permitted to refer to relevant workplace procedures/product and manufacturing specifications/codes/standards/manuals/reference materials.

#### Guidance information for

**EVIDENCE GUIDE****assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Material**

Hardwood, softwood or plywood sheeting, or a combination

**Materials for fastening, joining and sealing**

Marine-grade adhesives; sealant and caulking materials; metal fasteners (copper/silicon bronze/mone/stainless steel etc.).

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Marine craft construction
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## MEM25006B Undertake marine sheathing operations

### Modification History

Release 2 - Prerequisite unit code corrected MEM25004B

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying sheathing to marine structures (sheathing operations). Basic composite sheathing operations are covered by Unit MEM25001B (Apply fibre-reinforced materials).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit covers the application of sheathing to marine structures. Work is undertaken autonomously, in a team environment or a combination of both. Predetermined standards of quality and safety are observed and work is carried out to standard operational procedures.</p> <p>Tasks may be carried out on prepared new and old surface areas. Sealing may involve various materials to ensure a watertight seal on a variety of components.</p> <p>Where application of marine coatings is undertaken, Unit MEM08002C (Pre-treat work for subsequent surface coating) and/or Unit MEM08004B (Finish work using wet, dry and vapour deposition methods) should also be selected. Basic sheathing operations are covered by Unit MEM25001B (Apply fibre-reinforced materials).</p> <p>Where materials and chemicals subject to codes and regulations are stored, Unit MEM13003B (Work safely with industrial chemicals and materials) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM25004B	Fair and shape surfaces

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify job requirements	<p>1.1.Job specifications are identified from written and verbal instructions as appropriate.</p> <p>1.2.Surface materials are identified from specification or</p>

ELEMENT	PERFORMANCE CRITERIA
	verbal instructions. 1.3.Application schedules are identified.
2. Observe safety practices	2.1.Application material is prepared in accordance with manufacturer specifications. 2.2.Work area is made safe in accordance with organisational and legislative requirements. 2.3.Safety practices are observed and appropriate protective clothing is worn.
3. Prepare surface areas and apply materials	3.1.Surface area is prepared to suit job application. 3.2.Surface contaminants are removed using appropriate method. 3.3.Where applicable, non-contact surface areas are protected. 3.4.Measures to prevent external contamination are applied in accordance with organisational procedures. 3.5.Appropriate equipment is used to calibrate mixing quantities. 3.6.Hand tools for mixing and application are selected to suit job requirements
4. Prepare application materials	4.1.Materials are prepared/mixed in accordance with manufacturer specification. 4.2.Material quantities are calculated and cut to produce minimum wastage.
5. Apply materials	5.1.Application tools are selected and used correctly. 5.2.Application procedures are carried out in accordance with manufacturer specification. 5.3.Where applicable, job materials are held securely in place until curing process is achieved. 5.4.Excess material is removed. 5.5.Application tools are cleaned up and stored. 5.6.Job area is cleaned up to maximise safe working conditions.
6. Seal fabricated components	6.1.Surface preparation is completed as per manufacturer specification. 6.2.Sealant is applied to components and secured as per specifications and/or drawings. 6.3.Excess sealant is cleaned off and tested/checked to ensure water tightness.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying and clarifying sheathing application, material and other relevant specifications
- identifying surface materials
- preparing materials
- measuring sheathing material lengths to produce minimal wastage
- preparing site
- using personal protection
- mixing solutions in correct ratios
- preparing surface area, including the removal of contaminants
- selecting tools
- shielding surface areas not being sheathed
- applying materials
- minimising waste
- securing matting/cloth and waste overhang
- removing excess materials to produce minimum sanding/finishing requirements
- cleaning and storing tools
- sanding/re-coating sheathed surface area
- securing components/fittings
- cleaning and structurally testing fittings

#### Required knowledge

Look for evidence that confirms knowledge of:

- sheathing material specifications, properties and uses
- surface types, specifications, cleaning and preparation techniques
- site preparation and safe working practices
- sheathing preparation and safe working practices
- sealant types, specifications and uses
- masking procedures
- bonding/impregnating/reinforcing material specifications, properties and uses
- use of tools for sizing, measuring, mixing, applying sheathing and bonding/impregnating/reinforcing mixtures and finishing
- sealant application and finishing techniques

**REQUIRED SKILLS AND KNOWLEDGE**

- sheathing application
- waste minimisation techniques
- securing materials and waste overhang
- removal of excess resin
- waste disposal obligations and regulations
- cleaning and storage of tools
- sanding/re-coating
- water testing techniques

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to undertake marine sheathing operations. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with marine sheathing operations or other units requiring

<b>EVIDENCE GUIDE</b>	
	the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Surface materials</b>	Copper, gal sheet and other metals, fabric, sheathing resins, a range of adhesives, sealants and fillers and where applicable may be applied to timber, fibre-reinforced plastics and metal surface areas
<b>Hand tools for mixing and application</b>	Mixing sticks, putty/broad knives, scales, tins of equal size, trowels, squeegee, brushes and rollers

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Marine craft construction
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## MEM25007B Maintain marine vessel surfaces

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers performing cosmetic maintenance/repair of surfaces, including fibre reinforced plastics, timber and metal surfaces.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to cosmetic maintenance and repair practices used in the marine industry.</p> <p>Cosmetic maintenance and repair practices apply across a range of timber, fibre reinforced plastics and metal materials.</p> <p>Work involves routine maintenance-related inspection of hull and superstructure sectors, surfaces and fittings.</p> <p>A range of hand held tools, equipment and materials is used to suit specific maintenance/repair requirements.</p> <p>Where repair of marine surfaces and structures is carried out, Unit MEM25008C (Repair marine vessel surfaces and structures) should be selected.</p> <p>Where slipping is required, or when working on a slipped craft, Unit MEM25014B (Perform marine slipping operations) should also be selected.</p> <p>Relevant units related to specific applications and materials should also be selected as required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect vessel and identify maintenance/repair requirements	1.1.Sectors, surfaces and fittings requiring inspection are identified. 1.2.Condition of sectors/surfaces and fittings is established.

ELEMENT	PERFORMANCE CRITERIA
	1.3.Appropriate cosmetic maintenance/repair requirements and methods are established.
2. Clean and prepare vessel sectors and surfaces	2.1.Correct cleaning tools, equipment and materials are selected and used safely. 2.2.Fittings are cleaned and prepared for maintenance. 2.3.Surfaces and sectors are cleaned free of contaminants. 2.4.Safety practices are applied in accordance with organisational and legislative requirements.
3. Perform cosmetic maintenance/repair	3.1.Surfaces are correctly prepared, filled and faired ready for finishing. 3.2.Compatibility of re-coating materials is confirmed. 3.3.Material coatings are selected and applied correctly. 3.4.Fittings are maintained/replaced as appropriate. 3.5.Tools and equipment are cleaned and stored correctly.
4. Finish surfaces	4.1.Where applicable, surfaces are re-coated. 4.2.Where applicable, surfaces are sanded and buffed/polished to specification.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- implementing written and verbal instruction and specification
- recognising structure and components
- identifying surface coating and toxicity status of different sectors
- detecting faults, flaws and breakdowns in surface integrity
- preparing site to job, safety and environmental requirements
- selecting tools and equipment
- selecting cleaning/etching/cutting solutions and compounds, etc.
- using personal protective equipment (PPE)
- removing fittings, where required

**REQUIRED SKILLS AND KNOWLEDGE**

- preparing parts/sections in need of repair
- acquiring, preparing and applying fillers, caulking compounds, sealants, adhesives, gel-coats, etc., where required
- preparing surfaces in readiness for application of surface finishing and protective coatings, where required
- applying/restoring surface finishes and or protective coatings
- reinstalling/replacing fittings
- disposing of waste, and general housekeeping

**Required knowledge**

Look for evidence that confirms knowledge of:

- structure, component, and surface type identification
- written and verbal instruction and specification
- range of cleaning/etching/cutting solutions and compounds, etc.
- protective and preservative coatings
- fault and blemish identification
- types of fillers, caulking, sealants, adhesives and their uses
- operation of hand and mechanical tools including high- pressure cleaning devices
- safety measures, safe working procedures and personal protection
- methods of cleaning, performing cosmetic repair and surface preparation, finishing and preservation
- environmental impact of run-off and waste
- waste disposal obligations and regulations

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to maintain marine vessel surfaces. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the

<b>EVIDENCE GUIDE</b>	
<b>competency in this unit</b>	unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining marine vessel surfaces, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised

**RANGE STATEMENT**

wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Cosmetic maintenance/repair**

Cosmetic environmental and other damage including chips in fibre reinforced plastics, minor corrosion in metal, caulking in timber surfaces, wear and corrosion of fittings

**Cleaning tools, equipment and materials**

Hand scrapers and scouring pads, handheld power tools, abrasive materials and equipment and associated dust extraction accessories, high-pressure blast cleaning equipment and chemical cleaners such as acid wash, solvent, detergent

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Marine craft construction
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## MEM25008B Repair marine vessel surfaces and structures

### Modification History

Release 2 - Prerequisite unit code corrected MEM25004B

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers repairing marine structures and surfaces, including fibre reinforced plastics, timber and metal surfaces. Cosmetic maintenance/repair of surfaces is covered by Unit MEM25007C (Maintain marine vessel surfaces).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to repair of marine structures and surfaces. Work is undertaken autonomously, in a team environment or a combination.</p> <p>All practices may be applied to timber, fibre reinforced plastics, polycarbonates, acrylics, glass and metal materials.</p> <p>Repairs may relate to hull, superstructure and decks. Chosen repair methods must take account of stresses encountered by vessels at sea including but not limited to hogging, sagging, wracking, sheering, panting.</p> <p>A range of tools/equipment and materials is used to suit specified job requirements.</p> <p>All work is carried out observing all safety aspects of structural integrity. All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Where sheathing applications are required, Unit MEM25006B (Undertake marine sheathing operations) should also be selected.</p> <p>Where interpretation of technical drawings is required, Unit MEM09002B (Interpret technical drawing) should also be selected.</p> <p>Where location/erection of structures is required, Unit MEM25003B (Set up marine vessel structures) should also</p>
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	<p>be selected.</p> <p>Where mechanical systems/components/fittings are to be replaced, Unit MEM18055B (Dismantle, replace and assemble engineering components) should be selected.</p> <p>Where slipping is required, or when working on a slipped craft, Unit MEM25014B (Perform marine slipping operations) should also be selected.</p> <p>Relevant units related to specific applications and materials should also be selected as required.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM13003B	Work safely with industrial chemicals and materials
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM25004B	Fair and shape surfaces
	MEM25007C	Maintain marine vessel surfaces

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine nature and extent of damage and subsequent repair requirements	3.1.Damaged structural areas/sectors are identified and extent of damage is determined. 3.2.Repair requirements are determined.
2. Remove damaged sectors	3.3.Where applicable, damaged sector is reinforced/supported.
3. Repair damaged sectors	3.4.Damaged sector is removed. 3.5.Method of component replacement is determined. 3.6.Damaged components are repaired/constructed to specification. 3.7.Components are fastened using appropriate fastening practices. 3.8.Repaired surface area is prepared and re-coated to specifications. 3.9.Repairs are cleaned in accordance with delivery requirements.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE



**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- implementing written and verbal instruction
- recognising structure and components
- identifying type and extent of structural damage area/sector
- selecting suitable repair method and materials
- selecting and using tools/equipment
- preparing site to job, safety and environmental requirements
- preparing materials to affect repairs
- using personal protection
- sourcing and applying correct fastening methods
- disassembling components, where required
- repairing damage to timber, fibre reinforced plastics and metal surfaces and structures
- reassembling and or replacing components
- reconnecting/refitting through-hull fittings
- preparing surface in readiness for application of surface finishes and protective coatings, where required
- applying surface finishes and protective coatings, matching colours and textures, where required
- testing and re-establishing watertight integrity, where required
- disposing of waste, and general housekeeping

**Required knowledge**

Look for evidence that confirms knowledge of:

- structure, component, surface, core identification
- effect of damage in relation to the integrity of the hull and structures and the capacity of the vessel to withstand stresses encountered at sea
- repair methods and materials for timber, fibre reinforced plastics and metal surfaces and structures
- characteristics of chosen materials
- affect on structural and or watertight integrity
- tools/equipment, their specification and application
- techniques for reinforcement/shoring/support
- methods for re-constructing damaged components
- fastening methods and application procedure
- procedures used in preparing, re-finishing or re-coating
- types and applications of coatings

**REQUIRED SKILLS AND KNOWLEDGE**

- colour and texture matching techniques
- safe work procedures
- methods of testing and re-establishing watertight integrity
- procedures for pre-delivery clean up of damaged sector

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to repair marine vessel surfaces and structures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with repairing marine vessel surfaces and structures, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be

<b>EVIDENCE GUIDE</b>	
	gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Repairs</b>	<ul style="list-style-type: none"> <li>Foreign contact damage such as reef, jetty collision; environmental problems such as fungi, marine and insect effects on timber; variants of severe corrosion in metals, such as electrolysis and galvanic corrosion and with fibre reinforced plastics construction, such as osmosis</li> <li>Structural repair includes impediments to structural and watertight integrity, for example, holed hull, star-cracking in fibre reinforced plastics, replacement of hull and deck</li> <li>Planking, replacement of cracked hatch tops and portlight 'windows', hull penetration causing ingress of water</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Marine craft construction
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## MEM25009B Form timber shapes using hot processes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers forming solid timber shapes using hot processes. Laminating by cold processes is covered by Unit MEM25005B (Construct and assemble marine vessel timber components).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to typical applications in the construction of marine vessels including forming and shaping of structural and decorative components.</p> <p>Application and forming operations are conducted within a mould, existing structure or over a former assembly.</p> <p>Predetermined standards of quality and safety are observed and work is carried out following standard operational procedures.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Where straightforward construction and assembly of marine timber components is undertaken, including laminating by cold processes, Unit MEM25005B (Construct and assemble marine vessel timber components) should be selected.</p> <p>Where complex forming is required, Unit MEM09021B (Interpret and produce curved 3-dimensional shapes) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12023A	Perform engineering measurements
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Specifications are identified from drawings and instructions. 1.2. Appropriate bending process is selected and components are identified. 1.3. Construction sequence is determined. 1.4. Tools and equipment are selected and used appropriate to job requirements.
2. Prepare jigs and templates	2.1. Standard jigs/templates are selected to suit job application. 2.2. Jigs/templates are constructed to suit required shape.
3. Form timber shapes	3.1. Components are constructed to specifications using hot processes. 3.2. Where applicable, laminating/heating equipment is set up according to standard operating procedures, and safety practices are observed. 3.3. Components are constructed and shaped to specifications. 3.4. Final components conform to specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- selecting jig/template or fastening method relevant to form application
- using personal protection and applying safety precautions.
- selecting timber to specification and identifying faults
- preparing and operating heating/steaming equipment
- loading and unloading timber for heating/steaming.
- using tools, jigs, moulds and templates
- bending, shaping, assembling and or positioning timber components for clamping or fastening
- fixing clamps or fastenings

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<ul style="list-style-type: none"> <li>checking component size</li> </ul>
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>relevant job specifications</li> <li>safe working practice</li> <li>forming and component assembly practices</li> <li>heating/steaming equipment types and application</li> <li>heating times, temperatures and humidity requirements, where appropriate</li> <li>timber types, specifications and characteristics</li> <li>fault identification in material, such as twist, shakes, sloping grain</li> <li>forming and component assembly practice</li> <li>jig/templates types and their application</li> <li>jig/template construction process to suit specified shape</li> <li>bending and forming processes used for constructing components</li> <li>relevant laminating/heating equipment, their use and safety procedures</li> <li>heating, construction and shaping of components</li> <li>checking specified component size</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to form timber shapes using hot processes. Competency in this unit cannot be claimed until all prerequisites have been satisfied.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>
<b>Context of and specific resources for</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where</p>



**EVIDENCE GUIDE****assessment**

assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with forming timber shapes using hot processes, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Tools and equipment**

May include jigs, templates, steamboxes, cramps,

**RANGE STATEMENT**

	fasteners etc.
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**Unit Sector(s)**

Unit sector	
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**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	Marine craft construction
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## MEM25010B Perform fitout procedures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers fitting out marine vessels. It includes setout, construction, assembly and installation of a variety of components. Straightforward installation of fittings/accessories is covered by Unit MEM18002B (Use power tools/hand held operations).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to both 'on the job' and 'pre-fabricated structure fitouts'.</p> <p>This unit applies to setout, construction, assembly and installation of flooring/decking, partitions, door frames, portlights, hatches, windows, windscreens, non-structural bulkheads, deckheads, bunks, cupboards and other furniture, lining, engine room, galley etc. It includes installation of thermal, noise, vibration and fire control insulation materials.</p> <p>Work may be undertaken autonomously or as part of a team. All work is carried out safely and to specified industry standards for timber joinery, surface finish, appearance characteristics, dressing or plugging of fastenings, etc.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>An arrangement of hand and hand held power tools and machinery may be used for construction and installation requirements.</p> <p>Where construction of fibre reinforced plastics components is undertaken, Unit MEM25002B (Form and integrate fibre-reinforced structures) should also be selected.</p> <p>Where construction of solid timber shapes using hot</p>
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	<p>processes is undertaken, Unit MEM25009C (Form timber shapes using hot processes) should also be selected.</p> <p>For straightforward installation of fittings/accessories, Unit MEM18002B (Use power tools/hand held operations) should be selected. Where lines plan drawings and loftings are interpreted, Unit MEM09021B (Interpret and produce curved 3-dimensional shapes) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 4</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM25005B	Construct and assemble marine vessel timber components

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	1.1. Drawings are identified and checked for accuracy. 1.2. Specified job requirements are identified from fitout plans and procedures. 1.3. Materials for fitout are identified from fitout plans and procedures.
2. Construct fitout components	2.1. Take-off quantities are checked and cutting list is produced, if applicable. 2.2. Material is machined to suit job scantling sizes, strength and appearance requirements, where applicable. 2.3. Materials are marked/cut out to specification. 2.4. Components requiring assembly are clearly identified and the sequence of assembly is determined.
3. Assemble fitout components	3.1. Method of assembling and fastening components is identified. 3.2. Components are assembled to specifications. 3.3. Waste materials are removed in accordance with work practices and relevant legislation. 3.4. Surface area of assembled components is sanded for installation, where applicable. 3.5. Component surface is pre-coated for preservation,

ELEMENT	PERFORMANCE CRITERIA
	where applicable, according to standard specification and procedure.
4. Install components	<p>4.1.Surface area is marked for layout installation, where applicable.</p> <p>4.2.Fitting and levelling practices are applied.</p> <p>4.3.Fastenings are selected to suit job requirements.</p> <p>4.4.Components are fixed to meet specified job requirements.</p> <p>4.5.Clean work practices are applied for coating and adhesive applications.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- employing safe work practices
- selecting and checking drawings
- identifying job fixing methods, fitout components, scantling sizes, patterns and materials from fitout plans and procedures
- identifying component structure, materials and assembly procedure
- determining quantities and producing cutting list
- preparing site
- selecting and using tools/equipment
- marking out materials
- assembling, fitting, adjusting and fixing equipment and components
- checking assemblies against specifications for correct sizing and construction standard
- disposing of waste in accordance with legislative requirements
- selecting component parts for sanding
- treating surface areas
- testing for watertight integrity
- fixing structures
- preparing fitout structures for coating and adhesive applications

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Look for evidence that confirms knowledge of:

- safe work practice
- procedures used for drawing identification and accuracy
- common structures used in boat fitout
- job fixing methods, fitout components, materials and use of patterns
- procedures used for constructing and assembling component
- typical sizing, common species, strength and appearance requirements
- practice used for machining of material
- material characteristics in terms of species, strength, appearance grade
- marking and cutting procedures
- practices used in identification and assembly sequence
- assembly and fastening methods
- safe work practices and personal protective equipment
- waste disposal obligations and regulations
- surface preservation pre-coating and application method
- practices used for fitting and levelling
- type of fastenings and material species
- method of fixing/fastening applications
- watertight integrity testing methods and their application

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to fit out a marine craft with fixtures, furnishings and equipment using a range of materials and fastening methods. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required

<b>EVIDENCE GUIDE</b>	
	knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with fitting-out, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>



**RANGE STATEMENT**

situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Materials**

Timber, composites, fibre-reinforced plastics, acrylics, polycarbonates, glass and metal

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Marine craft construction

## MEM25011B Install marine systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers the installing and testing engine/plant and ancillary equipment relevant to propulsion, stability, steering and fuel systems for mechanically powered marine vessels.</p> <p>Straightforward installation only is covered by Unit MEM25015A (Assemble and install equipment and accessories/ancillaries).</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to practices for the installation and testing of engine/plant and ancillary equipment relevant to propulsion, stability, steering and fuel systems for mechanically powered marine vessels.</p> <p>Application may apply to drive systems such as inboard/outboard, water jet and side thrusting units (excluding outboard motor installation).</p> <p>Site locations may include new or existing external and internal locations for foundations, footings, beds and frameworks etc. completed prior to installation and commissioning.</p> <p>All specifications are applied using engineering drawings, written and verbal instructions. Straightforward modifications are of a minor nature not requiring specification changes or technical recording. Testing should be undertaken in accordance with manufacturer specifications, guidelines, requirements and limitations.</p> <p>Testing procedures may include engineering practices for determining correct operational function of mechanical, fluid power systems, equipment, components and associated items.</p> <p>Tasks may be undertaken in a workshop/site, moored or in</p>
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	<p>a sea-trial situation. Work may be undertaken autonomously or as part of a team. All work and work practices shall be undertaken to regulatory, legislative and manufacturer requirements.</p> <p>Where installation only is required, Unit MEM25015A (Assemble and install equipment and accessories/ancillaries) should be selected.</p> <p>Where technical drawings are interpreted, Unit MEM09002B (Interpret technical drawing) should also be considered.</p> <p>Where load shifting equipment, such as ride on forklifts/pallet trucks, is used, Unit MEM11010B (Operate mobile load shifting equipment) should also be considered.</p> <p>Where moveable and fixed load shifting equipment, such as pendant cranes, travelling overhead cranes, monorail hoists and chain blocks etc., is used, Unit MEM11022B (Operate fixed/moveable load shifting equipment) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 8</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare installation site	1.1.Site features are checked using appropriate measuring equipment. 1.2.Non-compliance with specification is reported to appropriate authority. 1.3.Modifications are undertaken with approval of appropriate authority. 1.4.Installation site and components are prepared.
2. Install marine engines/plant	2.1.All work is carried out safely, in accordance with site procedures and relevant Australian standards. 2.2.Engine/plant components and ancillary equipment are prepared for correct sequential installation. 2.3.Engine/plant is installed in accordance with manufacturer's site specifications. 2.4.Engine/plant is checked for conformance to specifications, and modifications/adjustments are undertaken to standard operating procedure. 2.5.Engine/plant is installed in accordance with specifications. 2.6.Site conditions are finalised in accordance with OHS requirements and standard procedures. 2.7.Documentation is completed to required specifications.

ELEMENT	PERFORMANCE CRITERIA
3. Test engine/plant systems and ancillary equipment	<p>3.1. Work/test requirements for engine/plant and ancillary equipment are identified.</p> <p>3.2. Engine/plant and ancillary equipment is tested for correct operation using instruments appropriate to the testing task.</p> <p>3.3. Operational function is assessed and verified.</p>
4. Collect data and localise fault conditions	<p>4.1. Drawings/diagrams and operational specifications are used to identify and localise fault conditions.</p> <p>4.2. Built-in fault indicators and error codes are examined and interpreted, and results are recorded to standard procedures.</p> <p>4.3. Fault condition is localised to major component level.</p>
5. Analyse and report test results	<p>5.1. Test results are analysed/verified against operational specifications and localised faults are confirmed.</p> <p>5.2. Potential and actual faults are reported according to standard procedures.</p> <p>5.3. Corrective action is planned.</p> <p>5.4. Action plan is recorded/documented.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting relevant drawings, specifications and instructions
- checking site for correct location, dimensions and levels
- preparing site
- preparing surfaces, materials and components for installation
- checking machine/plant for compliance
- following safety measures
- installing and fixing components
- levelling, aligning, coupling and connecting engine/plant (excluding electrical connections)

**REQUIRED SKILLS AND KNOWLEDGE**

- restoring site
- disposing of waste in accordance with legislative requirements
- completing reports and other documents
- interpreting operational data of engine/plant and ancillary equipment
- selecting and using test equipment
- testing and verifying engine/plant and ancillary equipment operation
- identifying faults from built-in fault indicators, error codes
- analysing test results against specifications for faults

**Required knowledge**

Look for evidence that confirms knowledge of:

- safe working practices
- equipment used to check various site features and their use
- marine systems, specifications, applications and non-compliance procedures
- applicable safety equipment and personal protective equipment
- relevant codes, standards
- fixing/fastening methods components
- levelling, alignment, coupling and connection requirements
- relevant person(s) for making electrical connections
- cleaning and clearing requirements
- waste disposal obligations and regulations
- reporting and recording requirements
- operational requirements/specifications of engine/plant and ancillary equipment
- testing procedures and principles
- normal operating characteristics of engine/plant and ancillary equipment
- faults and malfunctions
- error indications in built-in devices
- methods of determining fault condition
- procedures for reporting faults
- causes/faults in engine/plant and ancillary equipment
- procedures for recording/documenting corrective maintenance activity

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to install marine systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing marine systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Engine/plant components and ancillary equipment</b>	<ul style="list-style-type: none"> <li>• Stabilisers may include electric, hydraulic or mechanically operated fin and/or tab types</li> <li>• Steering systems may include hydraulic, cable and wire-operated units</li> <li>• Fuel systems may include petrol and diesel supply operations</li> </ul>
<b>Instruments</b>	Mechanical, pneumatic/electro-pneumatic, electronic (analog/digital) and associated instruments that measure variables such as temperature, pressure, flow rate, levels, lights, density or any other operational variable

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		



## Competency field

Competency field	Marine craft construction
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## MEM25012B Install and test operations of marine auxiliary systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers installing and testing marine auxiliary systems. Where installation only is required, Unit MEM25015A (Assemble and install equipment and accessories/ancillaries) should be selected.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to practices for the installation and testing of auxiliary systems for marine vessels, such as bilge, freshwater, fire (water) and sanitary plumbing systems. Work may be undertaken autonomously or as part of a team.</p> <p>Lifting systems include davits, crane and winch units.</p> <p>Locations may include external and internal locations for foundations, footings, beds and frameworks etc. completed prior to installation and commissioning.</p> <p>All specifications are applied via engineering drawings, written or verbal instructions.</p> <p>Routine modifications and alterations are of a minor nature not requiring specification changes or technical recording.</p> <p>Testing should be undertaken in accordance with manufacturer specifications, guidelines, requirements and limitations.</p> <p>Testing procedures may include engineering practices for determining correct operational function of mechanical, fluid power systems, equipment, components and associated items.</p> <p>Tasks may be undertaken in a workshop/site, moored or in a sea trial situation. All work and work practices should be</p>
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	<p>undertaken to regulatory and legislative requirements.</p> <p>Where installation only is required, Unit MEM25015A (Assemble and install equipment and accessories/ancillaries) should be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 6</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM13003B	Work safely with industrial chemicals and materials

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent
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	with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine job requirements	<p>1.1.Job requirements are established from plans, specifications, verbal instructions or visual inspections.</p> <p>1.2.Installation materials are identified.</p> <p>1.3.Compatibility of surface and fitting materials is identified.</p> <p>1.4.Installation site of system is identified.</p>
2. Select auxiliary system	<p>2.1.Auxiliary system is selected in accordance with job requirements.</p> <p>2.2.Material structure and installation procedures are identified.</p> <p>2.3.Associated installation/assembly, plans/instruction are identified and verified.</p>
3. Install auxiliary system	<p>3.1.Appropriate tools for specified installation are selected.</p> <p>3.2.Where applicable, structural area is cut to suit installation requirements.</p> <p>3.3.Where applicable, structural reinforcement is fitted to suit job requirement.</p> <p>3.4.Structural area is prepared for surface preparation.</p> <p>3.5.Coating sealants and/or isolation materials are applied to suit job requirements.</p> <p>3.6.Fastening methods are applied to suit job application.</p> <p>3.7.Installation procedures are applied in accordance with job specification.</p> <p>3.8.Clean work practices are applied.</p>
4. Test operation of auxiliary system	<p>4.1.Pre-test checks are applied and verified before standard testing procedures are actioned.</p> <p>4.2.Test operation procedures are identified and verified.</p> <p>4.3.Where required, test equipment is correctly set up and used in accordance with testing practice.</p> <p>4.4.System is tested in accordance with specified operational procedures.</p> <p>4.5.Faults are recorded/reported to appropriate</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>authorities.</p> <p>4.6.Faults are rectified and re-tested for correct operation.</p> <p>4.7.Final test operation is recorded and documented according to standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying material species such as metals, timber, resin and glass reinforcements from plans/drawing
- establishing compatibility of component material and structural surface
- identifying systems such as bilge, freshwater, plumbing
- selecting and using specific tools
- selecting and applying sealants, coatings/isolation materials, such as sikaflex, paints, flowcoat, nylon etc.
- selecting fastening method and type/materials species
- modifying structural components without compromising structural and watertight integrity
- assembling and installing systems in accordance with plans/verbal instruction
- maintaining/restoring watertight integrity
- disposing of waste materials
- testing and verifying correct system operation
- recording fault diagnosis information
- rectifying faults

#### Required knowledge

Look for evidence that confirms knowledge of:

- role of plans/specification used for installation of identified components
- species/types of materials and their uses
- compatibility of species/types of construction materials of component and surface
- material species/types of structure/system and installation process
- plans/instruction relevant to installation and assembly of selected system

**REQUIRED SKILLS AND KNOWLEDGE**

- tools associated with system installation and their uses
- effects of sea-going stresses on structure and components
- practices used in modifying structural components, to suit system applications
- procedures for applying the reinforcement to structural section
- method of sanding for surface preparation
- sealant coatings and/or isolation materials
- waste disposal obligations and regulations
- standard pre-testing checks
- role, function and set-up procedure of test equipment
- practice used in testing operation of installed system
- recording procedures for fault diagnosis and identification
- methods used for rectifying faults and re-testing of system operations
- test operation checklist and recording procedure for final test clearance

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to install and test operations of marine auxiliary systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment

**EVIDENCE GUIDE**

	<p>should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with installing and testing operations of marine auxiliary systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Test equipment**

Mechanical, pneumatic/electro-pneumatic, electronic (analog/digital) and associated instruments that measure variables such as temperature, pressure, flow rate, levels, light, density or any other process variable

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Marine craft construction
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## MEM25013B Produce three-dimensional plugs/moulds

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers manufacturing three dimensional plugs and, where applicable, solid and/or split moulds constructions used in marine vessel construction.
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### Application of the Unit

<b>Application of the unit</b>	<p>Work may be undertaken autonomously or as part of a team. Predetermined standards of quality and safety are observed and work is carried out following standard operating procedures relevant to industry standards.</p> <p>Tasks may include the use of hand and mechanical lay-up practices for plug/mould construction.</p> <p>Hand tools/ power tools and workshop machinery/equipment can also be used in conjunction with construction practices.</p> <p>This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 12</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM04018B	Perform general woodworking machine operations
	MEM09002B	Interpret technical drawing
	MEM12007D	Mark off/out structural fabrications and shapes
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM25002B	Form and integrate fibre-reinforced structures
	MEM25003B	Set up marine vessel structures

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine plug requirements	<p>1.1.Plug specifications are established from drawings, relevant documentation and client discussion, as appropriate.</p> <p>1.2.Plug construction materials are selected in accordance with job requirements and specifications.</p> <p>1.3.Plug coating materials are selected to meet specifications in accordance with organisational procedures.</p> <p>1.4.Appropriate tooling and machinery are selected.</p>
2. Construct plug	<p>2.1.Plug material/s are accurately marked out in accordance with plug construction requirements.</p> <p>2.2.Where applicable, plug release angles/taper, flanges and rounding/concaving of corners are carried out.</p> <p>2.3.Appropriate tools, machine/s and construction practices are used to construct plug.</p>
3. Finish plug	<p>3.1.Plug is checked for compliance with specifications/drawing.</p> <p>3.2.Where applicable, final finish coating/s is applied to plug where required to comply with specifications.</p> <p>3.3.Where applicable, plug is prepared for mould manufacturing in accordance with specifications or standard operating procedures.</p>
4. Determine mould requirements	<p>4.1.Mould construction specifications and drawings are interpreted.</p> <p>4.2.Mould construction materials are selected in accordance with specifications.</p> <p>4.3.Appropriate tools and machinery/equipment are selected for job application.</p>
5. Produce mould	<p>5.1.Tooling coat is applied to plug in accordance with standard application procedures.</p> <p>5.2.Construction materials are applied to plug in accordance with appropriate lay-up sequence and procedure.</p> <p>5.3.Where applicable, stiffening/bracing materials are applied in accordance with job requirements.</p> <p>5.4.Where applicable, mould is prepared for production run/s.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying materials, such as timber, plywood, fastenings, fillers etc. from specifications/drawings
- selecting and using hand tools, hand held power tools and workshop machinery to suit plug/mould construction
- marking out dimensions relevant to plug/mould components
- selecting and assembling materials
- constructing plugs and moulds
- modifying plugs/moulds through the addition of release angles/tapers, flanges, beads and rounding/concaving
- fitting reinforcement components and or materials
- checking external/internal dimensions against specification/drawings
- applying final finish coating/s
- sanding, buffing/polishing to preparing plug for mould lay-up
- removing and disposing of waste

#### Required knowledge

Look for evidence that confirms knowledge of:

- plug/mould construction materials, characteristics, applications
- plug/mould coating materials, characteristics, applications - including tooling coats
- correct dimensions and application procedures for marking out
- release angles/tapers, flanges, rounding/concaving of corner sections
- hand tools/hand held power tools and workshop machinery and their uses
- plug/mould construction methods
- if applicable, methods used to apply stiffening/bracing/reinforcement
- method of application and sequence of final finish coating
- procedures for sanding/buffing/polishing plug/mould
- fault identification and rectification
- waste removal and disposal procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to produce three-dimensional plugs/moulds. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing three-dimensional plugs/moulds, or other units requiring the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Materials**

Timber, metal, plastic, fibreglass composites, fillers etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Marine craft construction
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## MEM25014B Perform marine slipping operations

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing slipping facilities, hauling out and launching vessels using a range of methods appropriate to the slipping facility.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of marine vessels such as work/pleasure craft, yachts etc. to suit capacity of slipping facility.</p> <p>Work is undertaken in a team environment. Predetermined standards of quality and safety are observed and work is carried out following standard operational procedures.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Where boat is to be moored using the vessel's engine or with the assistance of a work boat, Unit MEM50009B (Safely operate a mechanically powered recreational boat) should be selected.</p> <p>Where travel lifts, forklifts and/or cranes are used, Unit MEM11010B (Operate mobile load shifting equipment) or other appropriate units should also be selected.</p> <p>If skills for drawing interpretation, marking out and constructing structures for slipping are required, appropriate units should also be selected.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Set up slipping facilities	<p>1.1.Set-up of slipping facility is determined to suit vessel in accordance with organisational and legislative requirements.</p> <p>1.2.Where applicable, measurements to suit hull structure are taken.</p> <p>1.3.Where applicable, hull support bearers are safely positioned to suit hull structure.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Perform hauling out procedures	2.1. Slipping facilities are positioned to suit slipping application. 2.2. Vessel is positioned to suit slipping set-up. 2.3. Vessel retaining ropes are selected and secured correctly, in accordance with slipping facility and vessel retaining requirements. 2.4. Vessel is grounded/levelled for positioning of hull support. 2.5. Hull support mechanics are correctly positioned. 2.6. Safety checks of vessel stability are carried out.
3. Perform launching procedures	3.1. Vessel support and slip devices are checked for safety. 3.2. Pre-launch safety checks for vessel seaworthiness are applied. 3.3. Launch practices are carried out according to standard procedure and organisational requirements. 3.4. Hull support devices are re-positioned to prevent obstruction during vessel removal. 3.5. Where applicable, vessel is moored using appropriate restraints.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying measurements relevant to positioning of hull structure on slipping facilities from plans/verbal instruction
- setting slip to accommodate vessel according to design, dimensions and weight
- providing/positioning relevant support bearer/blocks and arms according to design, dimensions and vessel weight
- operating slip and slipping machinery
- manoeuvring vessel in accordance with set-up of slipping facility
- securing vessel in preparation for slipping
- inspecting vessel when slipped to ensure adequacy of hull support

**REQUIRED SKILLS AND KNOWLEDGE**

- adjusting and fixing support mechanisms as required
- clearing site and preparing vessel for launching
- performing safety checks to ensure vessel stability and watertight integrity
- positioning hull supports, such as arms, slings, to allow clear passage for removal of vessel
- mooring vessel in accordance with requirements of mooring facility

**Required knowledge**

Look for evidence that confirms knowledge of:

- types of slipways and operational procedures
- interpretation of ships/boats drawings, slipping specifications or instructions
- safety and legislative requirements for slipping and launching vessels
- different types of hull structures, dimensions, vessel weights and appropriate slipping arrangements
- methods of supporting/securing vessel ready for slipping
- methods of supporting hull during and after slipping
- procedures for operating slipway and slipway machinery
- procedures for positioning slip and manoeuvring vessels
- techniques for trimming and final securing of slipped vessel and disengaging slipway machinery
- knots, lashings and their applications
- pre-launch preparation requirements
- safety checks to be performed
- checks to ensure stability and watertight integrity
- procedures used in launching vessels
- mooring methods
- procedures for recovering and securing slip

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to perform marine slipping operations.  
Competency in this unit cannot be claimed until all

<b>EVIDENCE GUIDE</b>	
	prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with performing marine slipping operations, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Vessel support and slip devices</b>	Slings, shoring, cables, stays, blocks, chocks etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Marine craft construction
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## MEM25015A Assemble and install equipment and accessories/ancillaries

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assembling and installing equipment and ancillaries/accessories.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to installation to predetermined positions/locations using drawings, instructions etc. It does not cover installation requiring substantial modification to the existing site or where components are replaced by the same or similar type. Typical applications may include marine vessel manufacture.</p> <p>Work is undertaken using new external and internal locations and sites. Foundations, footings, beds and framework are completed prior to installation practices. All specifications are applied via engineering drawings, written or verbal instructions.</p> <p>Where positions are determined, alignments are undertaken, testing within manufacturer specifications is required, Unit MEM25012B (Install and test operations of marine auxiliary systems) should be selected.</p> <p>Where installation requires substantial modification to the existing site, and is being replaced by the same or similar type, Unit MEM10006B (Install machine/plant), Unit MEM18006C (Repair and fit engineering components) should also be selected.</p> <p>Unit MEM18009B (Perform levelling and alignment of machines and engineering components) and Unit MEM18055B (Dismantle, replace and assemble engineering components) should be accessed.</p> <p>For production-related assembly work, Unit MEM03002B (Undertake precision assembly) should be selected. This</p>
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	<p>unit should not be selected if Unit MEM03002B (Undertake precision assembly) has already been selected.</p> <p>Where load shifting equipment, such as ride on forklifts/pallet trucks, is used, Unit MEM11010B (Operate mobile load shifting equipment) should also be considered.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
<b>Path 1</b>	MEM09002B	Interpret technical drawing
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range
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	statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect and prepare the installation site	1.1.Site is checked for location, dimension, levels, etc. using appropriate measuring equipment. 1.2.Non-compliance with specification is reported to appropriate authority. 1.3.Alteration and correction is undertaken with approval of appropriate authority. 1.4.All surfaces, materials and components are prepared for use.
2. Install machinery/plant and equipment	2.1.Work is carried out safely and in accordance with site procedures, standard operating procedures and legislative requirements. 2.2.Machine/equipment components are prepared for correct sequential installation. 2.3.Machinery/plant or equipment is installed in accordance with manufacturer and site specifications. 2.4.Routine modification/alterations are undertaken to operating procedures, where required. 2.5.Machine/equipment is levelled, aligned, connected or coupled where required (excluding electrical connections). 2.6.Site is cleaned and cleared of all debris and left in safe state.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading, interpreting and following information on written job instructions,



**REQUIRED SKILLS AND KNOWLEDGE**

specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents

- planning and sequencing operations
- checking and clarifying task-related information
- checking site and taking dimensions and measurements
- reporting non-compliance
- performing alterations or corrections
- preparing surfaces, materials and components for use
- checking component parts against specification
- working safely and in accordance with manufacturer, site and legislative requirements
- preparing machinery/plant or equipment to specifications and established procedures
- installing machinery/plant or equipment
- performing modifications/alterations
- undertake numerical operations within the scope of unit
- levelling, aligning, connecting and coupling machine/equipment to specifications
- packing/sealing through-hull fittings
- cleaning site

**Required knowledge**

Look for evidence that confirms knowledge of:

- appropriate levelling and measuring equipment and benefits of choice
- procedural standards
- non-compliance and the impact of such
- preparatory requirements and processes
- legislative requirements
- sequence of installation of parts
- installation procedures
- reasons for modifications/alterations and impact of modifications/alterations
- procedures for levelling and aligning
- impacts of misalignment
- cleaning procedures
- hazards and control measures associated with assembling and installing equipment and accessories/ancillaries, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to assemble and install equipment and accessories/ancillaries. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assembling and installing equipment and accessories/ancillaries, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Machine/equipment components**

Toe rails, cleats, bollards, bow-rollers, fairleads, stanchions, railings, non-powered and powered winches, engines and driving mechanisms, auxiliary power plants, desalinating units, stabiliser units, powered/non-powered davits, pumps and compressors etc.

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Marine craft construction
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# MEM26001A Lay up composites using open moulding techniques

## Modification History

Release 1 New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to fabricate composites using hand lay-up and/or chopper gun and/or other open moulding techniques.

## Application of the Unit

This unit covers one of the fundamental techniques for fabricating a composite product – open moulding techniques. These are the traditional methods of composite fabrication and provide great flexibility in application. Open moulding may be undertaken by an individual or a fabrication team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

This unit is one of three units covering the basic composite fabrication techniques, the other two being MEM26002A Lay up composites using vacuum closed moulding techniques and MEM26003A Lay up composites using pressure closed moulding techniques, which together are intended to ensure the composite tradesperson can undertake a basic fabrication using these methods.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and
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unit of competency. knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                            |      |  |
|---|----------------------------|------|--|
| 1 | Select process             | 1.1  | Identify product requirements  |
|   |                            | 1.2  | Select open moulding technique most appropriate to product requirements        |
|   |                            | 1.3  | Identify or develop required procedures to make product using selected process |
| 2 | Set up equipment/workplace | 2.1  | Select required items of equipment and ancillary equipment                     |
|   |                            | 2.2  | Prepare equipment and ancillary equipment, as required                         |
|   |                            | 2.3  | Assemble all equipment ready for use as required by procedure                  |
| 3 | Prepare materials          | 3.1  | Identify required reinforcing/reinforcing system                               |
|   |                            | 3.2  | Determine quantity of reinforcing required                                     |
|   |                            | 3.3  | Prepare reinforcing as required  |
|   |                            | 3.4  | Identify required resin system   |
|   |                            | 3.5  | Identify and control hazards   |
|   |                            | 3.6  | Determine quantity of resin components required                                |
|   |                            | 3.7  | Check adequate quantities are available  |
|   |                            | 3.8  | Mix resin  |
|   |                            | 3.9  | Minimise waste   |
|   |                            | 3.10 | Test resin   |
| 4 | Fabricate and adjust       | 4.1  | Apply gel coat, as required  |

- |                                      |     |   |
|--------------------------------------|-----|---|
| equipment and materials, as required | 4.2 | Apply resin and reinforcing, as required                            |
|                                      | 4.3 | Ensure required resin distribution                                  |
|                                      | 4.4 | Cure product  |
|                                      | 4.5 | Remove product from mould when ready                                |
|                                      | 4.6 | Perform final verification of meeting product requirements          |
| 5 Clean up and maintain equipment    | 5.1 | Clean all moulding and mixing equipment                             |
|                                      | 5.2 | Undertake minor maintenance, as required                            |
|                                      | 5.3 | Prepare for next use or storage, as required                        |
|                                      | 5.4 | Inspect equipment for faults and take appropriate corrective action |
|                                      | 5.5 | Store equipment, as required  |
|                                      | 5.6 | Minimise waste  |
|                                      | 5.7 | Dispose of waste, as appropriate                                    |
|                                      | 5.8 | Complete required logs and reports                                  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting specifications and instructions
- calculation of material quantities
- working safely and using personal protective equipment
- removing included air
- using rollers, brushes and/or chopper gun
- performing vacuum leak testing
- doing minor maintenance to chopper guns and/or pump systems (reciprocating airless pumps with air support)

- operating and maintaining solvent cleaner (filter)
- undertaking mechanically assisted movement of large parts (e.g. chain hoist)
- assembling, cleaning and preparing simple and complex moulds
- releasing product from simple and complex moulds (using jacks, air and water)
- applying release systems (wax)
- ensuring compliance to specifications

## Required knowledge

Required knowledge includes:

- preparation schedules, terminology and information relevant to standard work instructions
- applicable codes and regulations
- safe work practices and correct use of personal protective equipment
- release agents surface tension
- managing lay-up teams
- gel coat application
- reinforcement lay-up
- resin types and applications
- common tools/equipment and their maintenance
- correct laminating techniques and finishing off (e.g. detail consolidation/rolling, check consistency and evenness of resin/glass, remove air entrapment and check with light)
- managing post-cure requirements (e.g. air cure and oven cure)
- production environment variables, such as effect of humidity (e.g. epoxy backbone), temperature, ultraviolet (UV) light and contamination from other processes
- managing hazardous environments (e.g. styrene levels)
- function of catalysts, accelerators and promoters
- control of overspray
- storage of moulds
- housekeeping
- waste disposal

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessment for this unit of competency will occur on the job. It is essential that the process and equipment be
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	<p>understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"><li>• waste is minimised</li><li>• product is made efficiently and to standard</li><li>• tools and equipment are appropriately maintained.</li></ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the fabrication of suitable objects using open moulding techniques.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in composites trade work are required to apply their skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment must be included as part of the assessment process. Assessment judgements must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Open moulding techniques</b>	<p>Open moulding techniques may include:</p> <ul style="list-style-type: none"> <li>• hand lay-up</li> <li>• chopper gun</li> <li>• filament winding</li> </ul>
<b>Requirements of product</b>	<p>Requirements of product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Equipment</b>	<p>Equipment includes:</p> <ul style="list-style-type: none"> <li>• moulds and mould components</li> <li>• resin application and dispersion tools</li> </ul>
<b>Preparing reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required</li> <li>• any pre-treatment required</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p>

	<ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• contamination</li> <li>• air entrapment</li> <li>• resin rich</li> <li>• uneven distribution of resin</li> <li>• difficult mould shapes</li> <li>• resin curing too quickly</li> <li>• resin curing too slowly</li> <li>• failure to release</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26002A Lay up composites using vacuum closed moulding techniques**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to fabricate composites using a vacuum infusion processing (VIP) or other vacuum closed mould technique.

## **Application of the Unit**

This unit covers one of the fundamental techniques for fabricating a composite product – vacuum closed moulding techniques. There are many closed moulding techniques and this unit includes an awareness of all common forms of vacuum closed moulding and competence in at least one vacuum technique. Closed moulding may be undertaken by an individual or by a fabrication team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

This unit is one of three units covering the basic composite fabrication techniques, the other two being MEM26001A Lay up composites using open moulding techniques and MEM26003A Lay up composites using pressure closed moulding techniques, which together are intended to ensure the composite tradesperson can undertake a basic fabrication using these methods.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                        |     |  |
|---|------------------------|-----|--|
| 1 | Select process         | 1.1 | Identify product requirements  |
|   |                        | 1.2 | Select vacuum closed mould technique most appropriate to product requirements  |
|   |                        | 1.3 | Identify or develop required procedures to make product using selected process |
| 2 | Set up mould equipment | 2.1 | Select required items of equipment and ancillary equipment                     |
|   |                        | 2.2 | Prepare equipment and ancillary equipment, as required                         |
|   |                        | 2.3 | Pack mould according to procedures/laminate schedule                           |
|   |                        | 2.4 | Assemble all equipment ready for use as required by procedure                  |
| 3 | Prepare materials      | 3.1 | Identify required reinforcing/reinforcing system                               |
|   |                        | 3.2 | Determine quantity of reinforcing required                                     |
|   |                        | 3.3 | Prepare reinforcing, as required   |
|   |                        | 3.4 | Identify required resin system   |
|   |                        | 3.5 | Determine quantity of resin components required                                |
|   |                        | 3.6 | Check adequate quantities are available  |
|   |                        | 3.7 | Mix resin  |
|   |                        | 3.8 | Minimise waste   |

		3.9	Test resin
4	Fabricate and adjust equipment and materials, as required	4.1	Identify and control hazards
		4.2	Apply gel coat as required
		4.3	Introduce resin to mould
		4.4	Ensure air is vented, as required
		4.5	Ensure required resin distribution
		4.6	Cure product
		4.7	Remove product from mould when ready
5	Clean up and maintain tools and equipment	5.1	Clean all moulding and mixing equipment
		5.2	Undertake minor maintenance, as required
		5.3	Prepare for next use or storage, as required
		5.4	Inspect equipment and take appropriate action
		5.5	Store equipment, as required
		5.6	Minimise waste
		5.7	Dispose of waste, as appropriate

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- resin infusion:
  - applying tack tape
  - applying bag (pleats, sits well, and so on)
  - inlet and outlet plumbing (connect/disconnect)

- managing flow medium (e.g. cloth)
- managing cores, as required
- managing flow and gel times (relationship to positioning and spacing of lines)
- managing and monitoring vacuum pressure
- monitoring cure cycles
- checking for leaks
- accessing and operating relevant computer programs
- vacuum bagging:
  - see infusion + protect bag from contamination
  - applying breather cloth/films
  - applying of peel ply
- achieving correct ply location and orientation
- using release processes

## Required knowledge

Required knowledge includes:

- reinforcement and lay-up schedules (e.g. layers of reinforcement, direction and darts)
- release systems and processes
- tool sealing
- gel coating
- sealing of mould (use of tack tape (e.g. butyl (or other) mastic and mechanical seals and clamps)
- vacuum and vacuum systems, adjustment and measurement, and vacuum control (e.g. switches, controls and regulators)
- resin systems applicable to process (e.g. vacuum infusion or vacuum bagging – polyester and epoxy)
- gel times and working times
- initiator/catalyst or hardener rates to temperature (hot/cold)
- free amine/amine blushes
- heat curing requirements and how it is done (e.g. ovens, hot bonders (blankets), and autoclaves)
- heat curves
- TG (glass transition)
- understand design briefs (e.g. tool design and part lines)
- Darcy's Law and its application to the flow of resins through porous media (e.g. reinforcing and cores)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessment for this unit of competency will be on the job.</p> <p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• waste is minimised</li> <li>• product is made efficiently and to standard</li> <li>• tools and equipment are appropriately maintained.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the fabrication of suitable objects using closed mould techniques.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>Typically, persons engaged in composites trade work are required to apply their skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment must be included as part of the assessment process. Assessment judgements must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>



	The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	Procedures may be written, verbal, computer-based or in some other form, and may include: <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Requirements of product</b>	Requirements of product may be determined from various sources, including: <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Closed moulding techniques</b>	Closed moulding techniques include techniques which may have several names, including: <ul style="list-style-type: none"> <li>• resin infusion under flexible tooling (RIFT)</li> <li>• vacuum bagging</li> </ul>

	This may also be applied to other closed moulding techniques
<b>Mould equipment</b>	Mould equipment includes major items and ancillary items and may also include consumable equipment, such as: <ul style="list-style-type: none"><li>• airlines</li><li>• catchpots</li><li>• moulds and mould components</li><li>• infusion system for laminate</li></ul>
<b>Prepare reinforcing</b>	Preparing reinforcing includes: <ul style="list-style-type: none"><li>• cutting to size/shape, as required</li><li>• any pre-treatment required</li></ul>
<b>Logs and reports</b>	Logs and reports may include: <ul style="list-style-type: none"><li>• paper or electronic based</li><li>• verbal reports</li><li>• items found which require action</li></ul>
<b>Appropriate action</b>	Appropriate action includes: <ul style="list-style-type: none"><li>• determining problems needing action</li><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Typical problems</b>	Typical problems may include: <ul style="list-style-type: none"><li>• dead spots trapping air</li><li>• resin curing too quickly</li><li>• resin curing too slowly</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## **Unit Sector(s)**

Composites

## **Custom Content Section**

Not applicable.

# **MEM26003A Lay up composites using pressure closed moulding techniques**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to fabricate composites using a resin transfer moulding (RTM – resin under pressure), or other pressure closed mould technique.

## **Application of the Unit**

This unit covers one of the fundamental techniques for fabricating a composite product – pressure closed moulding techniques. There are many closed moulding techniques and this unit includes an awareness of all common forms of pressure closed moulding and competence in at least one pressure technique. Closed moulding may be undertaken by an individual or by a fabrication team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

This unit is one of three units covering the basic composite fabrication techniques, the other two being MEM26001A Lay up composites using open moulding techniques and MEM26002A Lay up composites using vacuum closed moulding techniques, which together are intended to ensure the composite tradesperson can undertake a basic fabrication using these methods.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Select process	1.1	Identify product requirements
		1.2	Select pressure closed mould technique most appropriate to product requirements
		1.3	Identify or develop required procedures to make product using selected process
2	Set up mould equipment	2.1	Select required items of equipment and ancillary equipment
		2.2	Prepare equipment and ancillary equipment, as required
		2.3	Pack mould according to procedures/laminate schedule
		2.4	Assemble all equipment ready for use as required by procedure
3	Prepare materials	3.1	Identify required reinforcing/reinforcing system
		3.2	Determine quantity of reinforcing required
		3.3	Prepare reinforcing, as required
		3.4	Identify required resin system
		3.5	Determine quantity of resin components required
		3.6	Check adequate quantities are available
		3.7	Mix resin
		3.8	Minimise waste

		3.9	Test resin
4	Fabricate and adjust equipment and materials, as required	4.1	Identify and control hazards
		4.2	Apply gel coat, as required
		4.3	Introduce resin to mould
		4.4	Ensure air is vented as required
		4.5	Ensure required resin distribution
		4.6	Cure product
		4.7	Remove product from mould when ready
5	Clean up and maintain tools and equipment	5.1	Clean all moulding and mixing equipment
		5.2	Undertake minor maintenance, as required
		5.3	Prepare for next use or storage, as required
		5.4	Inspect equipment and take appropriate action
		5.5	Store equipment, as required
		5.6	Minimise waste
		5.7	Dispose of waste, as appropriate

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- managing tools
- using release agents
- applying gel coats/surface finishes
- using catalyst systems for different resins and techniques

- achieving correct ply location and orientation
- applying mastic tape and sealing bag for resin infusion
- checking for bag sealing leaks
- connecting resin plumbing – inlet/outlet points
- accessing and operating computer programs
- monitoring curing cycles

## Required knowledge

Required knowledge includes:

- reinforcement and lay-up schedules (e.g. layers of reinforcement, direction and darts)
- release systems
- gel coating
- sealing of mould
- tool sealing
- resin systems applicable to process (polyester and epoxy)
- pressure systems and process monitoring
- gel times and working times
- initiator/catalyst or hardener rates to temperature (hot/cold)
- free amine/amine blushes
- heat curing requirements and how it is done (e.g. ovens, hot bonders (blankets), and autoclaves)
- heat curves
- TG (glass transition)
- understand design briefs (e.g. tool design and part lines)
- Darcy's Law and its application to the flow of resins through porous media (e.g. reinforcing and cores)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessment for this unit of competency will be on the job.  It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and
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	<p>analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• waste is minimised</li> <li>• product is made efficiently and to standard</li> <li>• tools and equipment are appropriately maintained.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the fabrication of a suitable object using closed mould techniques.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>Typically, persons engaged in composites trade work are required to apply their skills and techniques across a range of jobs and specifications.</p> <p>A single assessment event is not appropriate. On the job assessment must be included as part of the assessment process. Assessment judgements must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>



## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"><li>• all work instructions</li><li>• standard operating procedures</li><li>• formulas/recipes</li><li>• batch sheets</li><li>• temporary instructions</li><li>• any similar instructions provided for the smooth running of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li></ul>
<b>Requirements of product</b>	<p>Requirements of product may be determined from various sources, including:</p> <ul style="list-style-type: none"><li>• drawings</li><li>• product specifications</li><li>• customer requests</li><li>• descriptions of required use of product</li></ul>
<b>Closed moulding techniques</b>	<p>Closed moulding techniques include techniques which may have several names, including:</p> <ul style="list-style-type: none"><li>• RTM</li><li>• compression moulding</li></ul> <p>This may also be applied to other closed moulding techniques</p>
<b>Mould equipment</b>	<p>Mould equipment includes major items and ancillary items and may also include consumable equipment, such as:</p> <ul style="list-style-type: none"><li>• moulds and mould components</li><li>• infusion system for laminate</li></ul>
<b>Preparing reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"><li>• cutting to size/shape, as required</li><li>• any pre-treatment required</li></ul>

<b>Logs and reports</b>	Logs and reports may include: <ul style="list-style-type: none"><li>• paper or electronic based</li><li>• verbal reports</li><li>• items found which require action</li></ul>
<b>Appropriate action</b>	Appropriate action includes: <ul style="list-style-type: none"><li>• determining problems needing action</li><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Typical problems</b>	Typical problems may include: <ul style="list-style-type: none"><li>• dead spots trapping air</li><li>• resin curing too quickly</li><li>• resin curing too slowly</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# MEM26004A Make basic plugs for composites fabrication

## Modification History

Release 1 New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to make plugs for composites for routine or one-off production.

## Application of the Unit

This unit covers the fundamental techniques for making basic plugs. These are required to fabricate composite products and simple plugs may be made by the composites tradesperson. Plug making may be undertaken by an individual or by a team. It will typically require liaison with a wide range of stakeholders. It would typically be undertaken in a workshop or factory environment and may be used to manufacture new products, prototypes and samples, or to make repairs.

This unit does not cover the making of the plugs which require specialist patternmaking trade skills. See the relevant metals and engineering units of competency for these situations.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final product
		1.2	Determine features of plug required
		1.3	Identify or develop procedure to make plug
		1.4	Select tooling required to make plug
		1.5	Select materials for plug
2	Prepare for work	2.1	Prepare personal work plan
		2.2	Liaise with mould maker in relation to suitable plug
		2.3	Determine plug features
		2.4	Set up equipment/workplace
3	Prepare materials	3.1	Calculate surface area and required resin volume
		3.2	Develop cutting list for solid materials
		3.3	Mark out and cut out sheet materials, as required
		3.4	Calculate resin content
		3.5	Develop batch scale formulae for resin system
		3.6	Prepare non-composite materials to be used
		3.7	Measure resin components, as appropriate
		3.8	Minimise waste
4	Make plug	4.1	Identify and control hazards
		4.2	Mix resin system

		4.3	Fabricate plug
		4.4	Detail plug
5	Clean up and maintain equipment	5.1	Label and store plug for future use
		5.2	Clean and replace tools ready for next use
		5.3	Undertake any required minor maintenance of tools/equipment
		5.4	Clean work area and leave ready for next use
6	Anticipate common problems	6.1	Recognise problem/potential problem and take appropriate actions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using computer-aided design (CAD)/computer-aided manufacturing (CAM) applications
- using hand skills
- interpreting drawings
- using a range of machines (e.g. computer numeric control (CNC) and power routers)
- developing templates
- communicating with relevant personnel

### Required knowledge

Required knowledge includes:

- finishing resins
- tooling materials
- tooling resins
- parting lines
- design criteria/brief

- reverse engineering
- shrinkage
- cure values
- correct release agent
- thermal expansion
- open/closed mould (e.g. flange width and draft)
- resin transfer moulding (RTM) - metal vs composite mould
- closed mould (e.g. A/B side, bag it and silicon blanket)
- corners
- undercuts

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• plug functions as intended</li> <li>• plug allows for efficient fabrication of product.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the fabrication of suitable plugs using appropriate techniques.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of</p>

	<p>appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• product drawings and/or specifications)</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from</p>

	<p>various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Pug features</b>	<p>Plug features include:</p> <ul style="list-style-type: none"> <li>• relief</li> <li>• parting lines</li> <li>• efficient lay-up</li> </ul>
<b>Suitability of plug</b>	<p>Suitability of plug includes:</p> <ul style="list-style-type: none"> <li>• release angles</li> <li>• parting lines</li> </ul>
<b>Detail plug</b>	<p>Detail plug includes:</p> <ul style="list-style-type: none"> <li>• buff</li> <li>• fill</li> <li>• get ready for production</li> </ul>
<b>Routine faults</b>	<p>Typical routine faults may include:</p> <ul style="list-style-type: none"> <li>• gel coat sag</li> <li>• slow curing rates</li> <li>• blistering</li> <li>• wrinkles</li> <li>• pinholes</li> <li>• brush marks</li> <li>• poor surface finish</li> </ul>
<b>Non-routine faults</b>	<p>Non-routine faults, which may have multiple causes, may include:</p> <ul style="list-style-type: none"> <li>• release agents failure</li> <li>• mould release failure</li> <li>• warping or cracking after moulding</li> </ul>
<b>Typical process and product problems</b>	<p>Typical process and product problems may include:</p> <ul style="list-style-type: none"> <li>• structural strength, rigidity and stability of the tooling</li> <li>• dimensional accuracy of the tooling</li> <li>• allowances in the design for shrinkage, deformations and alterations in the process from tooling to mould to finished composite product</li> <li>• placement of flanges, closures, fitments, supports, struts and stiffeners</li> <li>• variations in materials and/or contamination of</li> </ul>



	materials
<b>Logs and reports</b>	Logs and reports may include: <ul style="list-style-type: none"><li>• paper or electronic based</li><li>• verbal reports</li><li>• items found which require action</li></ul>
<b>Appropriate action</b>	Appropriate action includes: <ul style="list-style-type: none"><li>• determining problems needing action</li><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# MEM26005A Make basic moulds for composites fabrication

## Modification History

Release 1    New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to make low pressure moulds for composites for routine or one-off production.

## Application of the Unit

This unit covers the fundamental techniques for making basic moulds. These are required to fabricate composite products and simple moulds may be made by the composites tradesperson. Mould making may be undertaken by an individual or by a team. It will typically require liaison with a wide range of stakeholders. It would typically be undertaken in a workshop or factory environment and may be used to manufacture new products, prototypes and samples, or to make repairs.

This unit does not cover the making of the moulds which require specialist patternmaking or metal fabrication trade skills. See the relevant metals and engineering units of competency for these situations.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills

unit of competency. and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final product
		1.2	Determine features of mould required
		1.3	Identify or develop procedure to make mould
		1.4	Select tooling required to make mould
		1.5	Select materials for mould
2	Prepare for work	2.1	Prepare personal work plan
		2.2	Liaise with plug maker in relation to suitable plug
		2.3	Determine mould features
		2.4	Set up equipment/workplace
3	Prepare materials	3.1	Calculate surface area and required resin volume
		3.2	Develop cutting list for solid materials
		3.3	Mark out and cut out sheet materials, as required
		3.4	Calculate resin content
		3.5	Develop batch scale formulae for resin system
		3.6	Prepare any non-composite materials to be used
		3.7	Measure resin components, as appropriate
		3.8	Minimise waste
4	Make mould	4.1	Identify and control hazards
		4.2	Check suitability of plug

		4.3	Prepare plug, as required
		4.4	Mix resin system
		4.5	Fabricate mould
		4.6	Release mould from plug
		4.7	Detail mould
5	Clean up and maintain equipment	5.1	Label and store mould for future use
		5.2	Clean and replace tools ready for next use
		5.3	Undertake any required minor maintenance of tools/equipment
		5.4	Clean work area and leave ready for next use
6	Anticipate common problems	6.1	Recognise problem/potential problem and take appropriate actions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using computer-aided design (CAD)/computer-aided manufacturing (CAM) applications
- using hand skills
- interpreting drawings
- operating a range of machine (e.g. computer numeric control (CNC) and power routers)
- developing templates (e.g. for hand moulds)
- communicating with relevant personnel

### Required knowledge

Required knowledge includes:

- finishing resins
- tooling materials
- tooling resins
- parting lines
- design criteria/brief
- reverse engineering
- shrinkage
- cure values
- correct release agent
- thermal expansion
- open/closed mould (e.g. flange width and draft)
- resin transfer moulding (RTM) - metal vs composite mould
- closed mould (e.g. A/B side, bag it and silicon blanket)
- corners
- undercuts

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• mould functions as intended</li> <li>• mould allows for efficient fabrication of product.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the fabrication of suitable moulds using appropriate techniques.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>

<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• product drawings and/or specifications</li> <li>• any similar instructions provided for the smooth</li> </ul>
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	<p>running of the plant</p> <ul style="list-style-type: none"> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Mould features</b>	<p>Mould features include:</p> <ul style="list-style-type: none"> <li>• relief,</li> <li>• parting lines</li> <li>• efficient lay-up</li> </ul>
<b>Suitability of plug</b>	<p>Suitability of plug includes:</p> <ul style="list-style-type: none"> <li>• release angles</li> <li>• parting lines</li> </ul>
<b>Prepare plug</b>	<p>Prepare plug includes:</p> <ul style="list-style-type: none"> <li>• cleaning</li> <li>• repairing surface blemishes</li> <li>• applying release systems</li> </ul>
<b>Detail mould</b>	<p>Detail mould includes:</p> <ul style="list-style-type: none"> <li>• buff</li> <li>• fill</li> <li>• get ready for production</li> </ul>
<b>Routine faults</b>	<p>Typical routine faults may include:</p> <ul style="list-style-type: none"> <li>• gel coat sag</li> <li>• slow curing rates</li> <li>• blistering</li> <li>• wrinkles</li> <li>• pinholes</li> <li>• brush marks</li> <li>• poor surface finish</li> </ul>
<b>Non-routine faults</b>	<p>Non-routine faults, which may have multiple causes, may include:</p> <ul style="list-style-type: none"> <li>• release agents failure</li> <li>• mould release failure</li> <li>• warping or cracking after moulding</li> </ul>

<b>Typical process and product problems</b>	<p>Typical process and product problems may include:</p> <ul style="list-style-type: none"> <li>• structural strength, rigidity and stability of the tooling</li> <li>• dimensional accuracy of the tooling</li> <li>• allowances in the design for shrinkage, deformations and alterations in the process from tooling to mould to finished composite product</li> <li>• placement of flanges, closures, fitments, supports, struts and stiffeners</li> <li>• variations in materials and/or contamination of materials</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.



# **MEM26006A Mark and cut out sheets for composite use**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to orient, mark out, create templates/lay flats for reinforcing, including woven, non-woven, pre-preg, cores, filler material, and so on.

## **Application of the Unit**

The marking out/cutting out of sheets used for composites can be significantly different to the marking out/cutting out of other materials, such as metals. Sheets used in composite fabrication often have significant directionality which must be considered. As a result of this composite design often includes different physical properties in one direction to another and so sheets must be marked and cut to align the required directional properties of the product with those of the sheets used in the fabrication.

Marking out/cutting out may be undertaken by an individual or a team. The mark out/cut out may be for use by the composites tradesperson themselves or they may be doing it to support production personnel. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine requirements of sheet material to be used
		1.3	Identify process to be used to fabricate product
2	Develop geometric shape, as required	2.1	Develop lay flats for regular solid rectilinear shapes
		2.2	Develop lay flats for regular curved/circular shapes
		2.3	Develop lay flats for transition pieces
		2.4	Develop lay flats for complex 3-D shapes
3	Orient required shape to suit directional differences of sheet	3.1	Identify directional properties in sheet
		3.2	Identify sheet-related directional requirements of product
		3.3	Identify orientations and alignments of lay flats with sheet
4	Mark out and cut sheet, as required	4.1	Identify and control hazards
		4.2	Place lay flat on sheet as required
		4.3	Arrange lay flats to minimise waste
		4.4	Prevent lay flat moving while in use
		4.5	Mark sheet, if required, using lay flat
		4.6	Cut sheet to meet requirements

- |   |  |     |  |
|---|--|-----|--|
| 5 | Store templates/lay flats, as required | 5.1 | Clean lay flats after use, as required                   |
|   |  | 5.2 | Label lay flat using identification protocol             |
|   |  | 5.3 | Record required directionality information with lay flat |
|   |  | 5.4 | Store lay flats according to procedures                  |
|   |  | 5.5 | Complete logs and reports, as required                   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting drawings and procedures
- using hand tools and power tools
- operating computer numeric controlled (CNC) machines
- measuring and marking out
- communicating with appropriate people
- performing basic computations

### Required knowledge

Required knowledge includes:

- orientation of plies/reinforcing
- direction of fibres (e.g. unidirectional, quad directional and on bias)
- weaves (e.g. plain, twill and satin)
- use for curves and compound curves
- creating patterns for a lay flat
- 3-D development of shapes

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• marks and cut outs are correct for shape</li> <li>• directionality is observed</li> <li>• other sheet properties are observed, as relevant.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the marking and cutting out of a range of suitable sheets used in reinforced composite fabrication.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy</p>

<b>assessment</b>	capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Sheets</b>	<p>Sheets include:</p> <ul style="list-style-type: none"> <li>• reinforcing:</li> <li>• woven</li> <li>• non-woven</li> <li>• pre-preg</li> <li>• cores</li> <li>• timber, such as MDF and plywood</li> <li>• filler material</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Requirements of sheet material</b>	<p>Requirements of sheet material include:</p> <ul style="list-style-type: none"> <li>• strength</li> <li>• flexibility/rigidity</li> </ul>

	<ul style="list-style-type: none"> <li>• thickness</li> <li>• density</li> <li>• directionality</li> <li>• drape</li> <li>• operating temperature</li> </ul>
<b>Lay flats</b>	<p>Lay flats (templates) are the geometric development of 3-D shape into a 2-D template which will allow the 3-D shape into be fabricated from a 2-D sheet. The lay flat may not take into account the required directionality.</p> <p>Lay flats may be:</p> <ul style="list-style-type: none"> <li>• physical (e.g. board and sheet metal)</li> <li>• virtual (e.g. coordinates and laser beam)</li> </ul>
<b>Regular rectilinear shapes</b>	<p>Regular rectilinear shapes include:</p> <ul style="list-style-type: none"> <li>• rectangular prisms</li> <li>• cubes</li> <li>• portions of prisms and cubes</li> <li>• similar shapes</li> </ul>
<b>Regular curved shapes</b>	<p>Regular curved shapes include:</p> <ul style="list-style-type: none"> <li>• cylinders</li> <li>• spheres</li> <li>• segments of cylinders and spheres</li> <li>• similar shapes</li> </ul>
<b>Transition pieces</b>	<p>Transition pieces include:</p> <ul style="list-style-type: none"> <li>• cones</li> <li>• pyramids</li> <li>• portions of cones and pyramids</li> <li>• square to round</li> <li>• tee piece</li> <li>• lobster back</li> <li>• similar shapes</li> </ul>
<b>Complex 3-D shapes</b>	<p>Complex 3-D shapes include:</p> <ul style="list-style-type: none"> <li>• other 3-D shapes which may need to be fabricated and which may be composed of a number of components of the above shapes</li> </ul>
<b>Alignment</b>	<p>Alignment may make reference to:</p> <ul style="list-style-type: none"> <li>• warp</li> <li>• weft</li> <li>• selvedge</li> </ul>

	<ul style="list-style-type: none"> <li>other features of the sheet</li> </ul> <p>Alignment also includes:</p> <ul style="list-style-type: none"> <li>the nesting of lay flats to optimise the use of materials and minimise waste</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may be:</p> <ul style="list-style-type: none"> <li>paper or electronic based</li> <li>verbal reports</li> <li>items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>determining problems needing action</li> <li>determining possible fault causes</li> <li>rectifying problem using appropriate solution within area of responsibility</li> <li>following through items initiated until final resolution has occurred</li> <li>reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>identifying directionality in sheet</li> <li>identify a feature to provide alignment</li> <li>products requiring multidirectional properties</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26007A Select and use reinforcing appropriate for product**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select specified reinforcement for a nominated job from what is normally used by organisation, as well as what is available commercially. It includes the science of reinforcing.

## **Application of the Unit**

This unit does not cover the selection of reinforcing for a structurally designed composite, although it may include working with a person undertaking a structural design. It may cover the redesign of an existing product (e.g. using a different process) or the design of a new product similar to an existing product.

This unit does not include the selection of a suitable resin system. Where the resin system also needs to be chosen refer to MEM26008A Select and use resin systems appropriate for product.

Reinforcing selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the reinforcing will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine requirements of reinforcing
		1.3	Select appropriate process to be used to fabricate product
2	Select most appropriate reinforcing for job	2.1	Compile specification of required reinforcing properties
		2.2	Compare required properties with specifications of available reinforcing
		2.3	Select most appropriate reinforcing
3	Evaluate selected reinforcement	3.1	Fabricate a sample using the selected reinforcing and nominated resin system
		3.2	Conduct/organise for relevant tests
		3.3	Evaluate process evaluation test (PET) results
		3.4	Review match of PET results with product requirements
		3.5	Review fabrication process
		3.6	Make any required changes to reinforcing or process
4	Fabricate product	4.1	Identify and control hazards
		4.2	Prepare selected reinforcing, as required

- 4.3 Lay reinforcing in correct direction, as appropriate
- 4.4 Mix nominated resin system, as required
- 4.5 Fabricate product using selected process
- 4.6 Minimise waste
- 4.7 Review product compared to requirements
- 4.8 Review reinforcing selection and fabrication process
- 4.9 Identify areas for improvement and take appropriate actions
- 4.10 Complete any required documentation/reporting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting quality control and quality assurance requirements
- interpreting specifications

### Required knowledge

Required knowledge includes:

- coloured fibres
- fibre types, costs and source (e.g. country/company)
- life cycle assessment
- types of weave
- types of material
- non-woven reinforcing (e.g. unidirectional, milled and chopped)
- how you buy reinforcing (e.g. toe, strands, gsm, width and weight in product)
- how the reinforcing is arranged
- exotic and hybrid reinforcing

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available reinforcing has been considered</li> <li>• an appropriate reinforcing has been chosen</li> <li>• the reasons for choosing the reinforcing are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the selection and use of appropriate reinforcing for specified composite jobs.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate</p>

	must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Requirements of reinforcing</b>	<p>Requirements of reinforcing include:</p> <ul style="list-style-type: none"> <li>• strength</li> <li>• flexibility/rigidity</li> <li>• directionality</li> <li>• drape</li> <li>• operating temperature</li> </ul>

<b>Most appropriate reinforcing</b>	<p>Most appropriate reinforcing refers to that reinforcing/reinforcing combination which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of use in manufacture</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Prepare reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required</li> <li>• any pre-treatment required</li> </ul>
<b>Reinforcing direction</b>	<p>Reinforcing direction includes considerations, such as:</p> <ul style="list-style-type: none"> <li>• fibre orientation</li> <li>• fibre pre-forming</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may be:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p>

	<ul style="list-style-type: none"><li>• cost/benefit of different reinforcing systems</li><li>• selecting a reinforcing suited to the fabrication process</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26008A Select and use resin systems appropriate for product**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select appropriate resins and resin systems for a job from what is normally used by organisation, as well as what is available commercially. It includes the chemistry of resins.

## **Application of the Unit**

This unit may cover the redesign of an existing product (e.g. using a different process) or the design of a new product similar to an existing product.

This unit does not include the selection of a suitable reinforcing system. Where the reinforcing system also needs to be chosen refer to MEM26007A Select and use reinforcing appropriate for product.

Resin selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the resin will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine requirements of resin system
		1.3	Select appropriate process to be used to fabricate product
2	Select most appropriate resin/resin system for job	2.1	Determine performance outcomes required from resin
		2.2	Interpret specifications of available resins
		2.3	Compare required properties with specifications of available resin systems
		2.4	Interpret material safety data sheets (MSDS) for possible resin systems
		2.5	Select most appropriate resin
3	Evaluate selected resin system	3.1	Identify current conditions impacting on resin chemistry
		3.2	Identify adjustments which may be made to meet current conditions
		3.3	Make allowable adjustments and monitor result
		3.4	Fabricate a sample using the selected resin system and nominated reinforcing
		3.5	Conduct/organise for relevant tests
		3.6	Evaluate process evaluation test (PET) results



- |   |                   |   |
|---|-------------------|---|
|   | 3.7               | Review match of PET results with product requirements       |
|   | 3.8               | Review fabrication process                                  |
|   | 3.9               | Make any required changes to resin system or process        |
| 4 | Fabricate product |   |
|   | 4.1               | Identify and control hazards                                |
|   | 4.2               | Prepare nominated reinforcing, as required                  |
|   | 4.3               | Lay reinforcing in correct direction, as appropriate        |
|   | 4.4               | Make any appropriate adjustments to the resin system recipe |
|   | 4.5               | Mix selected resin system, as required                      |
|   | 4.6               | Fabricate product using selected process                    |
|   | 4.7               | Minimise waste  |
|   | 4.8               | Review product compared to requirements                     |
|   | 4.9               | Review reinforcing selection and fabrication process        |
|   | 4.10              | Identify areas for improvement and take appropriate actions |
|   | 4.11              | Complete any required documentation/reporting               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting quality control and quality assurance requirements
- interpreting specifications
- interpreting product/technical data sheets and MSDS

### Required knowledge

Required knowledge includes:

- physical and chemical properties of resins
- resin types, cost and source
- catalyst types and systems (e.g. polyester and vinyl ester)
- hardener types (e.g. epoxy and phenolic)
- fillers and thickeners (e.g. mineral extenders, milled and cut fibre)
- catalyst hazards (e.g. self-accelerating decomposition temperature (SADTs))

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available resin systems have been considered</li> <li>• an appropriate resin system has been chosen</li> <li>• the reasons for choosing the resin system are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the selection and use of appropriate resin and resin systems for specified composite jobs.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the</p>

	<p>candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
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<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Requirements of resin system</b>	<p>Requirements of resin system include:</p> <ul style="list-style-type: none"> <li>• strength</li> <li>• flexibility/rigidity</li> <li>• surface finish and colour</li> <li>• shrinkage</li> <li>• chemical/ultraviolet (UV)/environmental resistance</li> <li>• operating temperature and heat distortion temperature</li> <li>• recyclability</li> </ul>
<b>Resin specification</b>	<p>Resin specification is also known as material or technical data sheet</p>
<b>Most appropriate resin</b>	<p>Most appropriate resin refers to that resin system/resin system which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of use in manufacture</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Preparing reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required</li> <li>• any pre-treatment required</li> </ul>
<b>Reinforcing direction</b>	<p>Reinforcing direction includes considerations, such as:</p>

	<ul style="list-style-type: none"> <li>• fibre orientation</li> <li>• fibre pre-forming</li> </ul>
<b>Resin system adjustments</b>	<p>Adjustments to the resin system chemistry may be as a result of:</p> <ul style="list-style-type: none"> <li>• temperature</li> <li>• humidity</li> <li>• required cure time</li> </ul> <p>Adjustments may only be made within the allowable limits of the system being used</p>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• cost/benefit of different resin systems</li> <li>• selecting a resin system suited to the fabrication process</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26009A Select and use cores and fillers appropriate for product**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select and use appropriate cores and fillers for a job from what is normally used by organisation, as well as what is available commercially. It includes purposes of cores and fillers, typical applications of core materials, strengths and weaknesses, and fabrication processes.

Some industry usage includes cores as a subset of reinforcing, but they are separated in this qualification for purposes of clarity.

## **Application of the Unit**

This unit may cover the redesign of an existing product (e.g. using a different process) or the design of a new product similar to an existing product.

This unit does not include the selection of a suitable resin system. Where the resin system also needs to be chosen refer to MEM2626008A Select and use resin systems appropriate for product.

This unit does not cover the selection of suitable reinforcing. Where reinforcing also needs to be chosen refer to MEM26007A Select and use reinforcing appropriate for product.

Core and filler selection and use may typically be undertaken by an individual in liaison with relevant stakeholders or it may undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the core and filler will be as part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine requirements of core and/or filler
		1.3	Select appropriate process to be used to fabricate product
2	Select most appropriate core and/or fillers for job	2.1	Compile specification of required composite properties relevant to the core and/or filler
		2.2	Compare required properties with specifications of available cores and/or fillers
		2.3	Select most appropriate core and/or filler
3	Evaluate selected core and/or filler	3.1	Fabricate a sample using the selected core and/or filler and nominated resin and reinforcing system
		3.2	Conduct/organise for relevant tests
		3.3	Evaluate process evaluation test (PET) results
		3.4	Review match of PET results with product requirements
		3.5	Review fabrication process
		3.6	Make any required changes to core, filler or process



- |   |                   |      |   |
|---|-------------------|------|---|
| 4 | Fabricate product | 4.1  | Identify and control hazards                                |
|   |                   | 4.2  | Prepare selected core and/or filler, as required            |
|   |                   | 4.3  | Lay core in correct direction, as appropriate               |
|   |                   | 4.4  | Prepare nominated reinforcing, as required                  |
|   |                   | 4.5  | Lay reinforcing in correct direction, as appropriate        |
|   |                   | 4.6  | Mix nominated resin system, as required                     |
|   |                   | 4.7  | Prepare and incorporate core and/or filler, as required     |
|   |                   | 4.8  | Fabricate product using selected process                    |
|   |                   | 4.9  | Minimise waste  |
|   |                   | 4.10 | Review product compared to requirements                     |
|   |                   | 4.11 | Review core and/or filler selection and fabrication process |
|   |                   | 4.12 | Identify areas for improvement and take appropriate actions |
|   |                   | 4.13 | Complete any required documentation/reporting               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using relevant hand and power tools
- fabricating composite products using appropriate techniques
- interpreting quality control and quality assurance requirements
- interpreting specifications
- interpreting product/technical data sheets and material safety data sheets (MSDS)

### Required knowledge

Required knowledge includes:

- types of cores
- chemical makeup of cores, including urethane, polyvinyl chloride (PVC), styrene acrylonitrile (SAN) (e.g. Corefell), polymethacrylimide (PMI) (e.g. Rohacell), wood (e.g. end grain balsa), cellulose (e.g. phenolic coated paper), polypropylene (PP), polyethylene (PE), aluminium honeycomb and aramid honeycomb (e.g. Nomex)
- types of fillers
- machining techniques
- function of cores and fillers
- bonding of cores and fillers
- wettability of cores and fillers by the resin
- properties of cores and fillers and their contributions to the properties of the composite
- interrelationship between cores, fillers and matrix
- modes of core failure

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available cores and/or fillers have been considered</li> <li>• an appropriate core/filler has been chosen</li> <li>• the reasons for choosing the core and/or filler are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the selection and use of appropriate cores and fillers for specified composite jobs.</p>

	Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> </ul>
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	<ul style="list-style-type: none"> <li>any similar instructions provided for the smooth running of the plant</li> <li>good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Cores</b>	<p>Core is used to include:</p> <ul style="list-style-type: none"> <li>materials used to provide thickness and so rigidity (and perhaps thermal and acoustic insulation) to a laminate, but not significant structural strength, which is provided by reinforcing</li> </ul>
<b>Fillers</b>	<p>Fillers include:</p> <ul style="list-style-type: none"> <li>particulate materials which may be added to the composite matrix to vary the bulk, stiffness, density or other properties of the final composite</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>drawings</li> <li>product specifications</li> <li>customer requests</li> <li>descriptions of required use of product</li> </ul>
<b>Requirements of core</b>	<p>Requirements of core include:</p> <ul style="list-style-type: none"> <li>stiffness/flexibility</li> <li>directionality</li> <li>density</li> <li>shear strength</li> <li>insulating properties</li> <li>operating temperature</li> </ul>
<b>Most appropriate core/filler</b>	<p>Most appropriate core/filler refers to that core/filler which has:</p> <ul style="list-style-type: none"> <li>compliance with product requirements</li> <li>greatest ease of use in manufacture</li> <li>best financial return</li> <li>greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>economic viability – efficiency, cost and waste reduction and competitiveness to support survival of</li> </ul>

	<p>the business</p> <ul style="list-style-type: none"> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety ( OHS)</li> </ul>
<b>Preparing core</b>	<p>Preparing core includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required</li> <li>• tapering edges, as required</li> <li>• any pre-treatment required (e.g. dehumidifying and priming)</li> </ul>
<b>Preparing reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required,</li> <li>• packaging into kits, as required</li> <li>• any pre-treatment required</li> </ul>
<b>Preparing filler</b>	<p>Preparing filler may include:</p> <ul style="list-style-type: none"> <li>• weighing</li> <li>• mixing with resin to required viscosity</li> <li>• any other required preparation</li> </ul> <p>Fillers may include:</p> <ul style="list-style-type: none"> <li>• fillers, such as syntactic foam</li> </ul>
<b>Core direction</b>	<p>Core direction includes considerations such as:</p> <ul style="list-style-type: none"> <li>• directional properties</li> </ul>
<b>Reinforcing direction</b>	<p>Reinforcing direction includes considerations such as:</p> <ul style="list-style-type: none"> <li>• fibre orientation</li> <li>• fibre pre-forming</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to</li> </ul>

	designated person
<b>Typical problems</b>	Typical problems may include: <ul style="list-style-type: none"><li>• cost/benefit of different core/filler systems</li><li>• air/vapour entrapment</li><li>• bonding/delaminating</li><li>• contamination</li><li>• selecting a core/filler suited to the fabrication process</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# MEM26010A Store and handle composite materials

## Modification History

Release 1 New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to recognise hazards, shelf life, commercial and other issues controlling appropriate storage and handling of materials used to make composites and storing and handling materials in accordance with work procedures.

## Application of the Unit

Storage of materials used to make composites is subject to a range of influences, including:

- chemical hazards (e.g. fire)
- physical hazards (e.g. manual handling)
- cost hazards (e.g. economic purchasing quantity vs shelf life)
- efficiency hazards (e.g. having the material where you need it when you need it)

This unit covers the determining of appropriate storage and handling protocols and procedures as well as storing and handling materials in accordance with these procedures.

Determining storage and handling requirements may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. This decision making may be undertaken in an office environment or at the worksite.

Storing and handling of materials in accordance with the procedures should be followed by all relevant personnel.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Identify properties and characteristics of materials used | 1.1 List all materials used on site<br>1.2 Interpret material safety data sheet (MSDS) for each material<br>1.3 Identify relevant manual handling issues<br>1.4 Identify environmental hazards for each material<br>1.5 Define the hazards for each material<br>1.6 Categorise materials into groups based on their hazards<br>1.7 Determine appropriate hazard controls |
| 2 | Identify key factors effecting storage and handling       | 2.1 Identify requirements for dangerous goods licence<br>2.2 Identify environmental regulation requirements<br>2.3 Identify occupational health and safety (OHS) requirements<br>2.4 Identify usage patterns and frequencies<br>2.5 Identify cost sensitivity to volume purchased<br>2.6 Identify shelf life   |
| 3 | Determine appropriate storage and                         | 3.1 Check manufacturer's storage and handling recommendations/requirements<br>3.2 Check MSDS   |



handling protocols	3.3	Check dangerous goods/environment protection agency (EPA)/OHS requirements
	3.4	Check company usage requirements
	3.5	Resolve conflicts between different requirements
	3.6	Prepare storage and handling procedure for materials
4 Store and handle materials in accordance with protocols	4.1	Identify and control hazards
	4.2	Use required handling aids
	4.3	Move material in accordance with procedures
	4.4	Store materials in accordance with procedures
	4.5	Monitor storage and handling of materials
	4.6	Take appropriate action

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- manual handling
- using mechanical handling devices

### Required knowledge

Required knowledge includes:

- MSDS and product data sheets
- material registers (e.g. set up hazardous goods register, maintain it and use it)
- personal protective equipment required (e.g. for reinforcement, resins and catalyst/hardener)
- bunding
- ventilation
- handling and storage and impact on product
- contamination (e.g. from water)
- storage temperature (e.g. low temperature for catalyst)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all hazards are appropriately identified</li> <li>• appropriate hazard controls are determined</li> <li>• appropriate storage and handling procedures are developed</li> <li>• appropriate storage and handling is practiced.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the determining appropriate storage and handling protocols and procedures and then using them for composite materials.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not</p>

	<p>require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>• resins</li> <li>• catalysts</li> <li>• promoters</li> <li>• solvents</li> <li>• reinforcing</li> <li>• cores</li> <li>• fillers</li> <li>• pigments</li> </ul>

	<ul style="list-style-type: none"> <li>• mould release</li> <li>• other materials used directly or indirectly in making products</li> </ul>
<b>Dangerous goods licence</b>	<p>The dangerous goods licence conditions may vary between states/territories and councils but will typically cover conditions related to:</p> <ul style="list-style-type: none"> <li>• fire</li> <li>• storage</li> <li>• the fee payable</li> </ul>
<b>Environmental regulations</b>	<p>Environmental regulations may be from any tier of government and will include:</p> <ul style="list-style-type: none"> <li>• trade waste</li> <li>• atmosphere</li> <li>• other wastes</li> <li>• other emissions</li> </ul>
<b>Hazard controls</b>	<p>Hazard controls should be based on the hierarchy of control:</p> <ul style="list-style-type: none"> <li>• eliminate</li> <li>• substitute</li> <li>• isolate</li> <li>• engineering controls</li> <li>• administrative controls</li> <li>• personal protective equipment</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• conflicting requirements</li> <li>• inadequate storage facilities</li> </ul>

<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence
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## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26011A Determine materials and techniques for a composite component or product**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select and use resin system/reinforcing combinations for a composite product. It includes the science of reinforcing, and core and resin interactions. It also includes basic design of a composite component/product but does not include structural design.

## **Application of the Unit**

This unit focuses in particular on the interactions between a resin system and the reinforcing, and also includes interactions with any core. Flow of fluid in porous media is described by Darcy's Law and this will need to be applied in this unit.

This unit builds on the units covering the selection and use of reinforcing and resins and in particular covers the interactions between resins and reinforcement.

This unit would typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. Determining materials and techniques may be undertaken in an office or laboratory environment or at the worksite.

The completion of the job will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEM26007A	Select and use reinforcing appropriate for product
MEM26008A	Select and use resin systems appropriate for product
MEM26009A	Select and use cores appropriate for product

MEM09002B

Interpret technical drawing

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine requirements of resin systems
		1.3	Determine requirements of reinforcing
		1.4	Determine requirements of cores
		1.5	Select appropriate process to be used to fabricate product
2	Identify suitable resin/ reinforcement/core systems	2.1	Examine previous laminate schedules for similar requirements
		2.2	Short list suitable resin systems
		2.3	Short list suitable reinforcing/reinforcing combinations
		2.4	Short list suitable cores
3	Evaluate properties of	3.1	Determine interactions between resin systems and reinforcing and cores

- |   |  |      |   |
|---|--|------|---|
|   | different resin/<br>reinforcement/core<br>combinations | 3.2  | Select most appropriate combination of resin systems, reinforcing and cores |
|   |  | 3.3  | Develop a laminate schedule to meet all requirements                        |
|   |  | 3.4  | Fabricate a sample of the most appropriate combination                      |
|   |  | 3.5  | Conduct/organise for relevant tests   |
|   |  | 3.6  | Evaluate process evaluation test (PET) results                              |
|   |  | 3.7  | Review match of PET results with product and sustainability requirements    |
|   |  | 3.8  | Review selection and fabrication process                                    |
|   |  | 3.9  | Make any required changes to appropriate combination or process             |
| 4 | Use selected combination for product                   | 4.1  | Identify and control hazards  |
|   |  | 4.2  | Prepare selected reinforcing, as required                                   |
|   |  | 4.3  | Lay reinforcing in correct direction, as appropriate                        |
|   |  | 4.4  | Prepare selected core, as required  |
|   |  | 4.5  | Lay core in correct direction, as appropriate                               |
|   |  | 4.6  | Make any appropriate adjustments to the resin system recipe                 |
|   |  | 4.7  | Mix selected resin system, as required                                      |
|   |  | 4.8  | Fabricate product using selected process                                    |
|   |  | 4.9  | Minimise waste  |
|   |  | 4.10 | Review product compared to requirements                                     |
|   |  | 4.11 | Review material selection and fabrication process                           |
|   |  | 4.12 | Identify areas for improvement and take appropriate actions                 |
|   |  | 4.13 | Complete any required documentation/reporting                               |



## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- making choices and justifying decisions
- interpreting design brief
- fabrication skills required to make product
- working unsupervised

### Required knowledge

Required knowledge includes:

- cost against known processes, including labour and machine output
- principles of adhesion and substrate/resin interactions
- bonding within and between composites:
  - inter-laminar delamination
  - secondary bonding delamination
- resin/reinforcement compatibility
- resin penetration
- permeability of reinforcement
- Darcy's Law and its application to the flow of resins through porous media (e.g. reinforcing and cores)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in
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	<p>implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available combinations of resin systems, reinforcing and cores have been considered</li> <li>• an appropriate combination has been chosen</li> <li>• the reasons for choosing the combination are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the designing and fabricating appropriate composite products or components.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Most appropriate combination</b>	<p>Most appropriate combination refers to that combination of resin systems, reinforcing/reinforcing combination and cores which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of manufacture</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Cores</b>	<p>Core is used to cover:</p> <ul style="list-style-type: none"> <li>• materials used to provide thickness and so rigidity (and perhaps thermal insulation) to a laminate, but</li> </ul>

	not significant structural strength, which is provided by reinforcing
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Requirements of core</b>	<p>Requirements of core include:</p> <ul style="list-style-type: none"> <li>• stiffness/flexibility</li> <li>• directionality</li> <li>• density</li> <li>• operating temperature</li> </ul>
<b>Preparing core</b>	<p>Preparing core includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required</li> <li>• any pre-treatment required</li> </ul>
<b>Preparing reinforcing</b>	<p>Preparing reinforcing includes:</p> <ul style="list-style-type: none"> <li>• cutting to size/shape, as required,</li> <li>• any pre-treatment required</li> </ul>
<b>Core direction</b>	<p>Core direction includes considerations such as:</p> <ul style="list-style-type: none"> <li>• directional properties</li> </ul>
<b>Reinforcing direction</b>	<p>Reinforcing direction includes considerations such as:</p> <ul style="list-style-type: none"> <li>• fibre orientation</li> <li>• fibre pre-forming</li> </ul>
<b>Requirements of resin system</b>	<p>Requirements of resin system include:</p> <ul style="list-style-type: none"> <li>• strength</li> <li>• flexibility/rigidity</li> <li>• surface finish and colour</li> <li>• chemical/ultraviolet (UV)/environmental resistance</li> <li>• operating temperature</li> <li>• recyclability</li> </ul>
<b>Resin system adjustments</b>	<p>Adjustments to the resin system chemistry may be as a result of:</p> <ul style="list-style-type: none"> <li>• temperature</li> <li>• humidity</li> <li>• required cure time</li> </ul> <p>Adjustments may only be made within the allowable</p>

	limits of the system being used
<b>Logs and reports</b>	Logs and reports may include: <ul style="list-style-type: none"><li>• paper or electronic based</li><li>• verbal reports</li><li>• items found which require action</li></ul>
<b>Appropriate action</b>	Appropriate action includes: <ul style="list-style-type: none"><li>• determining problems needing action</li><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Typical problems</b>	Typical problems may include: <ul style="list-style-type: none"><li>• cost/benefit of different combinations</li><li>• selecting a combination suited to the fabrication process</li><li>• maximising sustainability</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence.

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

## **MEM26012A Record and trial work processes for one-off composite products**

### **Modification History**

Release 1 New unit

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to take a one-off/prototype product or a new product/process from an internal or external developer and turn this into a standard manufacturing process which works and can be used in the plant. Refer also to MEM26018A Organise composite trials.

This unit can be used for recording composite materials and processing steps for one-off and prototype production.

### **Application of the Unit**

This unit covers the drafting of appropriate procedures for use in routine production or repair situations. It also requires the examination of a process and the comparison of it with standard practice in the workplace so that a workable procedure can be developed. The procedures are drafted from a developing process and are evaluated as part of this unit.

This unit would typically be undertaken by an individual in liaison with relevant stakeholders and by working closely with personnel developing the prototype.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency. demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Identify proposed benefits/outcomes of new product/process | 1.1 | Confirm deliverables expected by customer   |
|   |  | 1.2 | Confirm benefits expected by organisation   |
|   |  | 1.3 | Identify any existing products with similar expectations  |
|   |  | 1.4 | Note any relevant issues with existing similar products   |
| 2 | Sketch a process map/flow chart of proposed process        | 2.1 | Determine processes to be used  |
|   |  | 2.2 | Identify order of process steps   |
|   |  | 2.3 | Draw process map/flow chart of proposed process   |
|   |  | 2.4 | Annotate key resources to map/flow chart  |
|   |  | 2.5 | Examine map/flow chart for possible improvements  |
|   |  | 2.6 | Redraw map/flow chart, as appropriate   |
| 3 | Compare proposed process with current standard processes   | 3.1 | Identify processes which will be new to/changed from/deleted from existing similar process used by the organisation |
|   |  | 3.2 | Identify materials which will be new to/changed from/deleted from existing similar process or the organisation      |
|   |  | 3.3 | Identify areas of improvement in the existing similar process   |
|   |  | 3.4 | Identify hazards and appropriate hazard controls  |
|   |  | 3.5 | Develop procedures for new/modified steps   |

4	Draft procedures for new product/process	4.1	Locate appropriate template for procedures
		4.2	Observe and record prototype
		4.3	Draft procedures from successful prototype steps in appropriate format
5	Evaluate draft procedures	5.1	Keep tally of resources used
		5.2	Compare production to procedures
		5.3	Compare outcomes with expectations
		5.4	Identify any required changes
		5.5	Take appropriate action
6	Draft new procedures and obtain authorisation	6.1	Draft workable procedures
		6.2	Obtain authorisation of new procedures, as required
		6.3	Standardise procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills includes:

- writing
- developing procedures
- evaluating outcomes
- following authorisation procedures
- communicating with relevant personnel

### Required knowledge



Required knowledge includes:

- use of production tools (e.g. one-off or multiple products)
- limits of size which suggest easiest/most cost effective way to produce product
- fibre/resin ratio

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• a set of workable procedures have been developed</li> <li>• procedures have taken account of process mapping.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the development of new manufacturing specifications/procedures for composite products or components.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct</p>

	<p>observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Deliverables expected by customer</b>	<p>Deliverables expected by customer may include:</p> <ul style="list-style-type: none"> <li>• technical specification</li> <li>• aesthetic requirements</li> <li>• other quality expectations</li> <li>• cost/price expectations</li> <li>• quantity and delivery schedules</li> </ul>

<b>Key resources</b>	<p>Key resources include:</p> <ul style="list-style-type: none"> <li>• materials</li> <li>• labour</li> <li>• time</li> <li>• money</li> </ul>
<b>Process map improvements</b>	<p>Improvements made from process maps are typically a reduction in wastes (muda) as defined by</p> <ul style="list-style-type: none"> <li>• over-production</li> <li>• delay</li> <li>• transportation</li> <li>• over-processing</li> <li>• excess inventory/work in progress (WIP)</li> <li>• excess motion</li> <li>• defects</li> <li>• untapped human potential</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• multiple ways of doing the same job</li> <li>• waste built into procedures</li> <li>• aligning procedures with good practice</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## **Unit Sector(s)**

Composites

## **Custom Content Section**

Not applicable.

## **MEM26013A Select and use composite processes or systems appropriate for product**

### **Modification History**

Release 1 New unit

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select the one most appropriate process for a job from all common composite processes.

### **Application of the Unit**

This unit covers the selection of processes or systems for the redesign of an existing product (e.g. using a different process) or the design of a new product similar to an existing product.

This unit does not include the selection of suitable materials. Where materials also need to be chosen refer to MEM26011A Determine materials and techniques for a composite component or product.

Process/system selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the process/system will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |      |   |
|---|--|------|---|
| 1 | Identify process requirements of product | 1.1  | Determine physical characteristics of product   |
|   |  | 1.2  | Determine chemical characteristics of product   |
|   |  | 1.3  | Determine aesthetic characteristics of product  |
|   |  | 1.4  | Determine production volume and delivery schedule   |
|   |  | 1.5  | Determine regulatory requirements   |
| 2 | Select most appropriate process/system   | 2.1  | Identify processes which can deliver requirements of product                                |
|   |  | 2.2  | Determine the capability of the organisation to meet the requirements and use the processes |
|   |  | 2.3  | Evaluate each process against the requirements  |
|   |  | 2.4  | Select most appropriate process   |
|   |  | 2.5  | Fabricate a sample using most appropriate process   |
|   |  | 2.6  | Conduct/organise for relevant tests   |
|   |  | 2.7  | Evaluate process evaluation test (PET) results  |
|   |  | 2.8  | Review match of PET results with product and sustainability requirements                    |
|   |  | 2.9  | Review selected fabrication process   |
|   |  | 2.10 | Make any required changes to process  |

- |   |                             |     |  |
|---|-----------------------------|-----|--|
| 3 | Use process to make product | 3.1 | Identify and control hazards                               |
|   |                             | 3.2 | Fabricate product using selected process                   |
|   |                             | 3.3 | Minimise waste   |
|   |                             | 3.4 | Review product compared to requirements                    |
|   |                             | 3.5 | Review fabrication process                                 |
|   |                             | 3.6 | Identify areas for improvement and take corrective actions |
|   |                             | 3.7 | Complete any required documentation/reporting              |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating technical information
- making decisions
- identifying product characteristics
- using relevant equipment

### Required knowledge

Required knowledge includes:

- cost analysis for each process to select best process
- technical standards/suitability
- mechanical stresses
- life cycle assessment for each process
- ease of manufacture
- testing criteria
- failure modes effects analysis (FMEA)
- typical applications of each major type of process, strengths and weaknesses
- grid analysis

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available processes have been considered</li> <li>• an appropriate process has been selected</li> <li>• the reasons for choosing the process are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the selection and use of appropriate composite processes or making the required products or components.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<p><b>Method of assessment</b></p>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not</p>



	<p>require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form. They include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued</li> </ul>

	survival within the community and the survival of the community, including occupational health and safety (OHS)
<b>Physical characteristics of product</b>	Physical characteristics of product include: <ul style="list-style-type: none"> <li>• size</li> <li>• shape</li> <li>• weight</li> <li>• requiring one/two part mould</li> <li>• light weight</li> <li>• high strength</li> <li>• erosion resistant</li> </ul>
<b>Chemical characteristics of product</b>	Chemical characteristics of product include: <ul style="list-style-type: none"> <li>• corrosion resistant</li> <li>• fire retardant</li> <li>• ultraviolet (UV) resistant</li> </ul>
<b>Aesthetic characteristics of product</b>	Aesthetic characteristics of product include: <ul style="list-style-type: none"> <li>• finish (e.g. gloss, buffed and matt)</li> <li>• colour</li> </ul>
<b>Regulatory requirements</b>	Regulatory requirements include: <ul style="list-style-type: none"> <li>• dangerous goods</li> <li>• OHS</li> <li>• environment protection agency (EPA)</li> </ul>
<b>Appropriate</b>	Appropriate includes: <ul style="list-style-type: none"> <li>• technical</li> <li>• practical</li> <li>• cost</li> <li>• sustainability criteria</li> </ul>
<b>Logs and reports</b>	Logs and reports may include: <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	Appropriate action includes: <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> </ul>

	<ul style="list-style-type: none"> <li>reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>cost/benefit of different processes</li> <li>selecting a process suited to the customer needs</li> <li>selecting a process within the organisation capability</li> <li>maximising sustainability</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26014A Adjust resin chemicals for current conditions**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the knowledge of resin chemistry, particularly catalysis and resin curing, to make adjustments to the chemistry to suit current requirements caused by weather, job specifications or other factors. It also requires knowing the limits of these adjustments and having discussions with suppliers/manufacturers regarding resin chemistry.

## **Application of the Unit**

This unit applies to situations where the fabricator has the ability to make limited modifications to the resin composition in order to make a better product. This unit includes knowing the limits that can be made to adjustments and also when no adjustments can be made.

This unit may cover existing products, repairs or the development of new products.

Decisions regarding resin chemistry adjustment may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team and will typically occur at the worksite.

Use of the adjusted chemistry will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |      |   |
|---|---|------|---|
| 1 | Identify current conditions impacting on resin chemistry          | 1.1  | Identify variables for the chemistry of resin types   |
|   |   | 1.2  | Identify impacts on resin chemistry of environmental changes                                  |
|   |   | 1.3  | Observe current environmental conditions  |
|   |   | 1.4  | Predict impact of current conditions on resin chemistry                                       |
| 2 | Identify adjustments which may be made to meet current conditions | 2.1  | Determine impact on resin chemistry of changing resin composition                             |
|   |   | 2.2  | Select resin composition changes to counteract impact of current conditions                   |
|   |   | 2.3  | Compare selected composition changes with adjustments allowed by manufacturer of resin system |
|   |   | 2.4  | Select most appropriate resin composition changes   |
|   |   | 2.5  | Identify alternative process changes to adjust for conditions                                 |
|   |   | 2.6  | Fabricate a sample using the selected adjustment  |
|   |   | 2.7  | Conduct/organise for relevant tests   |
|   |   | 2.8  | Evaluate process evaluation test (PET) results  |
|   |   | 2.9  | Review match of PET results with product requirements   |
|   |   | 2.10 | Review resin composition changes  |
|   |   | 2.11 | Take appropriate action   |

3	Fabricate product using adjusted composition/ conditions	3.1	Identify and control hazards
		3.2	Make any appropriate adjustments to the resin system recipe
		3.3	Prepare materials, as required
		3.4	Prepare tools and equipment, as required
		3.5	Minimise waste
		3.6	Review product compared to requirements
		3.7	Review chemistry modification process
		3.8	Identify areas for improvement and take appropriate actions
		3.9	Complete any required documentation/reporting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- mixing resins
- interpreting weather/environment characteristics
- interpreting catalyst temperature
- communicating with relevant personnel
- completing documentation
- reporting outcomes

### Required knowledge

Required knowledge includes:

- summer/winter catalyst
- resin chemistry
- curing/cross linking chemistry
- basic chemistry of resin manufacture

- effects of temperature (workplace and materials), humidity, air flow (wind) and concentration
- effect of adjustments in the workplace (and why)
- adjustments available from supplier

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• environmental conditions are correctly interpreted</li> <li>• impact on resin chemistry is understood</li> <li>• appropriate adjustments are made</li> <li>• the reasons for selecting the adjustments are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the adjusting of resin chemistry to meet particular requirements, the justification of those changes and making products with the adjusted chemistry.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of</p>

	<p>application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Resin chemistry</b>	<p>Resin chemistry includes:</p> <ul style="list-style-type: none"> <li>• process of curing/cross linking of resins</li> <li>• rate of cure and change of properties over cure time</li> </ul>



	<ul style="list-style-type: none"> <li>• changes in viscosity and other flow properties during progress of cure</li> <li>• final properties of resin post-cure</li> </ul>
<b>Environmental changes</b>	<p>Environmental changes may include:</p> <ul style="list-style-type: none"> <li>• temperature</li> <li>• humidity</li> <li>• air flow/wind</li> <li>• solar/ultraviolet (UV) insolation</li> </ul>
<b>Resin composition</b>	<p>Resin composition includes:</p> <ul style="list-style-type: none"> <li>• resin/catalyst ratio</li> <li>• resin/promoter ratio</li> <li>• resin/catalyst/promoter ratios</li> <li>• changing temperature of resin components (e.g. using chilled catalyst or resin)</li> <li>• ratios of other resin system components</li> </ul>
<b>Most appropriate resin composition changes</b>	<p>Most appropriate resin composition changes refers to those resin system changes which:</p> <ul style="list-style-type: none"> <li>• comply with product requirements</li> <li>• adjust for the current conditions</li> <li>• have greatest ease of use in manufacture</li> <li>• have best financial return</li> <li>• have greatest sustainability contribution</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• making any required changes to resin composition changes</li> <li>• deferring the fabrication until more suitable conditions prevail</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>

<b>Alternative process changes</b>	<p>Alternative process changes may include:</p> <ul style="list-style-type: none"> <li>controlling the environmental conditions</li> <li>moving the timing of the job to when conditions are more favourable (e.g. at night)</li> <li>moving the location of the job to where conditions are more favourable (e.g. in plant, different site and in shade)</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>paper or electronic based</li> <li>verbal reports</li> <li>items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>determining problems needing action</li> <li>determining possible fault causes</li> <li>rectifying problem using appropriate solution within area of responsibility</li> <li>following through items initiated until final resolution has occurred</li> <li>reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>unusually hot/cold workplace/weather</li> <li>extreme humidity</li> <li>very tight/unusual specification of properties required of product</li> <li>high/low air flow/wind</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26015A Select and apply repair techniques**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to select and apply appropriate repair techniques.

## **Application of the Unit**

This unit cover the diagnosis of an area needing repair and selecting the appropriate repair techniques and then making the repair. It includes any incidental design which may be relevant to the repair. It may not be appropriate in situations where repair techniques are highly specified and controlled.

This unit does not include the selection of a suitable resin system, refer to MEM26008A Select and use resin systems appropriate for product.

Repair technique selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may undertaken by a team. Selection may be undertaken partially in an office environment or at the worksite.

Use of the repair technique and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Diagnose the item needing repair                 | 1.1 Clean out damaged area<br>1.2 Determine accessibility of area to be repaired<br>1.3 Inspect damaged area<br>1.4 Identify original materials of construction<br>1.5 Determine cause of failure to the extent possible  |
| 2 | Determine requirements of the repair             | 2.1 Check insurance status<br>2.2 Confirm intended usage of composite<br>2.3 Determine extent of repair required (e.g. structural or cosmetic)<br>2.4 Undertake appropriate incidental design<br>2.5 Agree on scope of repair   |
| 3 | Select most appropriate repair technique for job | 3.1 Check the availability of standard repair kits/components and techniques<br>3.2 Short list suitable repair techniques and materials<br>3.3 Evaluate suitability of possible repair techniques and materials<br>3.4 Select appropriate repair process<br>3.5 Select appropriate materials for repair<br>3.6 Conduct process evaluation tests (PET), as appropriate |

- |   |                  |      |   |
|---|------------------|------|---|
| 4 | Undertake repair | 4.1  | Identify and control hazards                                |
|   |                  | 4.2  | Create necessary access to damaged area                     |
|   |                  | 4.3  | Prepare area requiring repair                               |
|   |                  | 4.4  | Prepare tools and equipment required for repair             |
|   |                  | 4.5  | Prepare materials required for repair                       |
|   |                  | 4.6  | Undertake required repair                                   |
|   |                  | 4.7  | Minimise waste  |
|   |                  | 4.8  | Review repaired product compared to requirements            |
|   |                  | 4.9  | Review material selection and fabrication process           |
|   |                  | 4.10 | Identify areas for improvement and take appropriate actions |
|   |                  | 4.11 | Complete any required documentation/reporting               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- hand moulding
- hand lay-up skills
- applying resin infusion techniques
- applying taper sanding techniques
- applying syringe techniques
- using ultraviolet (UV) curable resin systems
- using other open and closed mould techniques

### Required knowledge

Required knowledge includes:

- different repair techniques (e.g. patch repair, honeycomb repair and resin surface repair), uses and limitations
- dedicated repair materials
- blocking techniques
- hot bonders
- temporary moulds
- repairing internal or external surfaces
- repairing against a mould
- mixing and using gel coat and gel coat additives (e.g. filler, wax, catalyst and pigment)
- laminate defects, such as air entrapment, moisture entrapment, osmosis and delamination

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available repair techniques and materials were considered</li> <li>• appropriate techniques and materials have been selected</li> <li>• the reasons for choosing the technique and materials are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require diagnosing items requiring repair, selecting suitable methods, justifying methods chosen, and then repairing items using those methods.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>

<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> </ul>
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	<ul style="list-style-type: none"> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Appropriate repair process</b>	<p>Appropriate repair process refers to that combination of materials and fabrication techniques which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of execution</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Incidental design</b>	<p>Incidental design includes minor design which is incidental to conducting a repair and which:</p> <ul style="list-style-type: none"> <li>• improves on an original design weakness (e.g. such as might be shown up by the failure being repaired)</li> <li>• changes the original design to incorporate current techniques, materials or practices</li> <li>• better meets customer needs</li> </ul>
<b>Preparing materials</b>	<p>Preparing materials includes:</p> <ul style="list-style-type: none"> <li>• cutting to size and shape, as required</li> <li>• any pre-treatment required</li> <li>• calculating amount of resin and resin components required</li> <li>• mixing resin systems</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p>

	<ul style="list-style-type: none"><li>• determining problems needing action</li><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"><li>• cost/benefit of different repair techniques and materials</li><li>• customer wants more improvement than is technically feasible</li><li>• customer wants more improvements than insurance will pay for</li></ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26016A Select and use joining techniques**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to join composites to other composite components or other materials, either as part of manufacturing or for a repair. The join will need to conform to the requirements of the job and so may need to be rigid or flexible, water, ultraviolet (UV), chemical or fire resistant, or have other properties, as well as the required strength.

## **Application of the Unit**

This unit covers joining which may include:

- bonding (e.g. adhesive, gluing, methacrylate, sikaflex and epoxy)
- using composite materials (e.g. Probond, Divelett, K-Lite and Eurmere)
- secondary bonding (e.g. cured composite to cured composite)
- using mechanical fasteners (e.g. bolts and rivets).

Selection of the joining technique may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the joining technique may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine characteristics required of the join	1.1	Determine finished application properties
		1.2	Develop required technical specifications of join
		1.3	Identify properties of surfaces to be joined
2	Select most appropriate joining system	2.1	Short list suitable joining techniques and materials
		2.2	Compare technical properties of different joining systems with requirements
		2.3	Check material safety data sheets (MSDS) of joining materials
		2.4	Determine preparation required of surfaces to be joined
		2.5	Select most appropriate joining system
		2.6	Make sample join using the system
		2.7	Conduct/organise for relevant tests
		2.8	Evaluate process evaluation test (PET) results
		2.9	Review match of PET results with product requirements
		2.10	Review fabrication process
		2.11	Make any required changes to system
3	Complete the required join	3.1	Identify and control hazards
		3.2	Prepare surface, as required

- 3.3 Prepare tools and equipment required for join
- 3.4 Prepare materials required for join
- 3.5 Undertake required join
- 3.6 Minimise waste
- 3.7 Review joined product compared to requirements
- 3.8 Review materials and techniques selected
- 3.9 Identify areas for improvement and take appropriate actions
- 3.10 Complete any required documentation/reporting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing surfaces
- using hand and power tools
- applying assembly techniques
- applying bonding techniques
- applying joiner

### Required knowledge

Required knowledge includes:

- adhesives (e.g. plexus – methylmethacrylate)
- sealants (e.g. sikaflex – silicon or butyl mastic)
- mechanical joining
- substrates and interactions with joiner
- surface preparation of substrate
- application methods
- clamping forces (minimum and maximum)

- adhesive/sealant thickness
- primers
- design rules around fastening (e.g. minimum area for pop rivets, rivet spacing and rivet patterns)
- edge finish of pilot holes
- quality requirements with the hole preparation
- quality requirements with the installation of fasteners
- radius of edge of laminate
- effect of flatness and smoothness of joining surfaces
- substrate composition in joining area

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably available joining techniques and materials were considered</li> <li>• appropriate techniques and materials have been selected</li> <li>• the reasons for choosing the technique and materials are sound</li> <li>• the product meets its required performance.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment will require the selection of joining methods, justifying the selection made and making a number of joints using both mechanical and adhesive joining techniques.</p> <p>Assessment will occur over a range of situations which</p>

	will include disruptions to normal, smooth operation.
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth</li> </ul>
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	<p>running of the plant</p> <ul style="list-style-type: none"> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Joining system</b>	<p>Joining system includes techniques and materials, such as:</p> <ul style="list-style-type: none"> <li>• bonding (e.g. adhesive, gluing, ethacrylates, sikaflex and epoxy)</li> <li>• using composite materials (e.g. Probond, Divelett, K-Lite and Eurmere)</li> <li>• secondary bonding – cured composite to cured composite</li> <li>• using mechanical fasteners (e.g. bolts and rivets)</li> </ul>
<b>Finished application properties</b>	<p>Finished application properties include:</p> <ul style="list-style-type: none"> <li>• permanent/removable</li> <li>• waterproof/chemical resistant</li> <li>• structural rigidity</li> <li>• strength (tensile, compressive, shear and torsional)</li> <li>• aesthetic</li> </ul>
<b>Properties of surfaces to be joined</b>	<p>Properties of surfaces to be joined include:</p> <ul style="list-style-type: none"> <li>• materials of construction</li> <li>• physical properties (e.g. strength and rigidity)</li> <li>• surface properties (e.g. surface finish and surface treatment/coatings)</li> <li>• size and shape</li> </ul>
<b>Preparation of surfaces</b>	<p>Preparation of surfaces to be joined may include:</p> <ul style="list-style-type: none"> <li>• solvent or other chemical cleaning</li> <li>• chemical etching</li> <li>• mechanical preparation such as blasting, buffing</li> <li>• surface smoothing (e.g. machining)</li> <li>• making of holes or other physical locking features</li> </ul>
<b>Most appropriate joining system</b>	<p>Most appropriate system refers to that system which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of joining</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact</li> </ul>



	<p>of the business to ensure the survival of the physical environment</p> <ul style="list-style-type: none"> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• incompatible requirements</li> <li>• hazardous materials/preparation methods</li> <li>• non-uniform join</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# MEM26017A Prepare composite or other substrate surfaces

## Modification History

Release 1 New unit

## Unit Descriptor

This unit of competency covers the skills and knowledge required to prepare, by abrasive or chemical means, a composite surface prior to bonding or coating. It includes the preparation of composite surfaces and other surfaces which are used in conjunction with composites (e.g. metal surfaces).

## Application of the Unit

This unit includes preparation of composite surfaces either as a finish or in preparation for further work, such as coating or joining.

Surface preparation may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes, samples or to make repairs.

This unit complements MEM26016A Select and use joining techniques.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Determine characteristics required of substrate       | 1.1 Identify the chemistry of materials to be applied to the surface   |
|   |   | 1.2 Identify the surface chemistry of the substrate  |
|   |   | 1.3 Determine any chemical treatments needed to make the substrate compatible with the materials to be applied |
|   |   | 1.4 Interpret material safety data sheets (MSDS) for materials which may be used                               |
|   |   | 1.5 Identify the current physical state of the substrate   |
|   |   | 1.6 Identify possible required physical states of the substrate  |
|   |   |  |
| 2 | Select most appropriate preparation technique for job | 2.1 Compile specification for required substrate preparation   |
|   |   | 2.2 Compare possible substrate preparation methods with specification  |
|   |   | 2.3 Select most appropriate substrate preparation  |
|   |   | 2.4 Conduct and evaluate process evaluation test (PET), as appropriate   |
|   |   | 2.5 Review selection and substrate preparation   |
|   |   | 2.6 Make any required changes to substrate preparation   |
|   |   |  |
| 3 | Prepare substrate                                     | 3.1 Identify and control hazards   |
|   |   | 3.2 Prepare substrate, as required   |
|   |   | 3.3 Minimise waste   |
|   |   | 3.4 Review result compared to requirements   |
|   |   | 3.5 Review substrate preparation process   |
|   |   | 3.6 Identify areas for improvement and take appropriate  |

actions

- 3.7 Clean up and perform any routine maintenance required on equipment
- 3.8 Complete any required documentation/reporting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills includes:

- controlling blasting equipment
- operating abrasive equipment by hand
- using chemical treatment equipment

### Required knowledge

Required knowledge includes:

- methods of abrasive cleaning
- purposes for abrasive cleaning
- types of abrasives and their applications (e.g. sand, bead, shot, soda and grit)
- protection of non-blasted surfaces
- waste control, reuse and disposal
- occupational health and safety (OHS) issues
- environmental considerations
- surface preparation standards (e.g. surface measurement and surface finish)
- types of chemical cleaning (e.g. etching and solvents)
- aniline preparation of aluminium

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• all reasonably suitable substrate preparation methods have been considered</li> <li>• an appropriate substrate preparation has been chosen</li> <li>• the reasons for choosing the substrate preparation are sound</li> <li>• the product meets its requirements.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the selection of appropriate substrate preparation methods, justification of those choices, and then the application of those methods to prepare given substrates for applications.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace</p>

	procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Most appropriate substrate preparation</b>	<p>Appropriate substrate preparation refers to that substrate preparation which has:</p> <ul style="list-style-type: none"> <li>• compliance with product requirements</li> <li>• greatest ease of preparation</li> <li>• best financial return</li> <li>• greatest sustainability contribution</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> </ul>

	<ul style="list-style-type: none"> <li>social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including OHS</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>paper or electronic based</li> <li>verbal reports</li> <li>items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>determining problems needing action</li> <li>determining possible fault causes</li> <li>rectifying problem using appropriate solution within area of responsibility</li> <li>following through items initiated until final resolution has occurred</li> <li>reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>incompatible surface applications with substrates</li> <li>non-uniform substrate preparation</li> <li>the use of hazardous materials</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.



# **MEM26018A Organise composite trials**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to trial new materials and processes and make prototypes. The source of these trials may arise from internal improvements or new products/processes from external sources. Regardless, trials need to be conducted to 'prove' it in an industrial environment, to translate research and development into practical processes and to provide appropriate records and metrics.

## **Application of the Unit**

This unit does not cover the selection of materials or processes but does cover the organising and analysing of trials to prove proposed new materials or processes in the production environment.

Trials may be undertaken by others, with this unit applying to the person organising the trials, or the same person may organise and undertake the trial. Organising the trial may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. Organising of trials may be undertaken partially in an office environment or at the worksite. The trial itself may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine expected outcomes from new/revised product/process	1.1	Identify risks to be controlled
		1.2	Identify novel parts of process/materials/properties
		1.3	Compare data from past work/trials
		1.4	Obtain data for novel part of process/material
		1.5	Develop procedures which should produce the required result
2	Determine required metrics from trials	2.1	Determine required process properties
		2.2	Determine required business measures
		2.3	Determine required sustainability measures
3	Compare proposed process with existing and predict problem areas	3.1	Compare proposed process with existing similar processes
		3.2	Identify points of difference
		3.3	Identify weaknesses with existing process
		3.4	Predict possible problems with trial process/materials
4	Organise appropriate trials	4.1	Determine scale of trial
		4.2	Ensure availability of adequate resources
		4.3	Organise for the preparation of equipment/materials

- |   |  |  |
|---|--|--|
|   | 4.4  | Conduct trial  |
|   | 4.5  | Monitor trial and record key observations and metrics    |
| 5 | Select appropriate manufacturing procedure | 5.1 Compare outcome with requirements                    |
|   |  | 5.2 Modify procedure and repeat trial, as required       |
|   |  | 5.3 Determine procedure which will yield desired results |
|   |  | 5.4 Record procedure in appropriate form                 |
|   |  | 5.5 Complete all required reporting and recording        |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- writing
- communicating
- interpreting computer-aided design (CAD) model
- interpreting data
- interpreting design brief
- analysing trial results
- preparing reports

### Required knowledge

Required knowledge includes:

- intended outcome of product
- design of documents for the floor
- design of trials
- design test requirements for trial

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"> <li>• appropriate metrics are determined before commencement of trial</li> <li>• trial procedure has a sound basis</li> <li>• trial procedures, metrics and outcomes are suitably recorded.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the organising of composite trials and analysing and reporting of trial results.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>

	The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Novel part</b>	<p>The novel part is that portion of the process, or the materials or product properties which are new or different to standard and could be:</p> <ul style="list-style-type: none"> <li>• new resin system on standard reinforcing</li> <li>• new reinforcing with standard resin system</li> <li>• new process using standard materials</li> <li>• standard process and materials producing product with different properties</li> </ul>
<b>Process properties</b>	<p>Process properties include:</p> <ul style="list-style-type: none"> <li>• gel time</li> <li>• viscosity</li> </ul>

	<ul style="list-style-type: none"> <li>• temperature (e.g. mould, resin and ambient)</li> <li>• infusion time</li> <li>• peak exotherm (e.g. using a laser thermometer)</li> </ul>
<b>Scale of trial</b>	<p>Scale of trial may be:</p> <ul style="list-style-type: none"> <li>• full scale prototype</li> <li>• scaled down prototype</li> <li>• laminate samples only</li> <li>• portion of laminate</li> </ul>
<b>Trial resources</b>	<p>Trial resources may include:</p> <ul style="list-style-type: none"> <li>• equipment</li> <li>• tools</li> <li>• materials</li> <li>• personnel</li> <li>• time</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Business measures</b>	<p>Business measures include:</p> <ul style="list-style-type: none"> <li>• costs</li> <li>• time analysis</li> <li>• quality reliability</li> </ul>
<b>Sustainability</b>	<p>Sustainability incorporates the three aspects of:</p> <ul style="list-style-type: none"> <li>• survival of the ecology/physical environment – which means that an enterprise needs to manage the impact of the business to ensure the survival of the physical environment</li> <li>• economic viability – efficiency, cost and waste reduction and competitiveness to support survival of the business</li> </ul>

	<ul style="list-style-type: none"> <li>• social sustainability – an enterprise needs to manage the impact of the business to ensure its continued survival within the community and the survival of the community, including occupational health and safety (OHS)</li> </ul>
<b>Modifying procedure</b>	<p>Modifying procedure may include:</p> <ul style="list-style-type: none"> <li>• changing resin inlets</li> <li>• changing resin chemistry</li> <li>• changing other materials</li> <li>• modifications to process</li> <li>• modifications to tooling</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• trial procedures not workable</li> <li>• trial product does not meet specification</li> <li>• trial procedures do not meet sustainability requirements</li> </ul>
<b>Health, safety and environment (HSE)</b>	<p>All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence</p>

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26019A Finish a composite product**

## **Modification History**

Release 1 New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to mechanically finish a composite product. There are a range of mechanical techniques used and the appropriate technique needs to be selected for a job and then used.

## **Application of the Unit**

This unit covers the selection and use of the appropriate mechanical finishing technique for a composite product. This unit does not cover gel coating or similar but may include gel coat repairs, moulding imperfection repairs, repairs to moulds and detailing.

Finishing technique selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may be undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the finishing technique will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to



essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret product requirements	1.1	Determine requirements of final products
		1.2	Determine finish requirements
2	Select most appropriate finishing for job	2.1	Compare required finish with results of different finishing methods
		2.2	Select most appropriate finishing method
		2.3	Conduct a process evaluation test (PET), where appropriate, and review finishing method, as required
3	Finish product	3.1	Identify and control hazards
		3.2	Prepare finishing equipment, tools and materials, as required
		3.3	Finish product using selected process
		3.4	Minimise waste
		3.5	Review finished product compared to requirements
		3.6	Identify areas for improvement and take appropriate actions
		3.7	Complete any required documentation/reporting

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- using hand tools
- using power tools and machine tools
- observing finished surfaces
- interpreting and applying procedures
- reporting, as required

## Required knowledge

Required knowledge includes:

- deburring
- sanding
- surface preparation
- preparing cut edges
- drill bits and sizes
- measurement of tools and relationship to finished size
- choice of tool
- gel coat repair, metal flake, dual colour and touch up chips

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p> <ul style="list-style-type: none"><li>• all reasonably appropriate finishing methods have been considered</li><li>• an appropriate finishing procedure has been chosen</li></ul>
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	<ul style="list-style-type: none"> <li>the reasons for choosing the finishing process are sound</li> <li>the product finish meets its requirements.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the selection of mechanical finishing methods, justifying those choices and finishing products using those methods.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with

training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Techniques</b>	<p>Techniques might include:</p> <ul style="list-style-type: none"> <li>• trimming</li> <li>• forming holes (drilling, hole saw or other penetration) using hand, power or machine tools</li> <li>• using jigs and fixtures</li> <li>• removing burrs</li> </ul>
<b>Finishing</b>	<p>Finishing may include:</p> <ul style="list-style-type: none"> <li>• machining</li> <li>• polishing</li> <li>• buffing</li> <li>• blasting</li> <li>• etching</li> <li>• making holes</li> </ul>
<b>Requirements of final product</b>	<p>Requirements of final product may be determined from various sources, including:</p> <ul style="list-style-type: none"> <li>• drawings</li> <li>• product specifications</li> <li>• customer requests</li> <li>• descriptions of required use of product</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> </ul>

	<ul style="list-style-type: none"><li>• determining possible fault causes</li><li>• rectifying problem using appropriate solution within area of responsibility</li><li>• following through items initiated until final resolution has occurred</li><li>• reporting problems outside area of responsibility to designated person</li></ul>
<b>Typical problems</b>	Typical problems may include: <ul style="list-style-type: none"><li>• damage to laminate from finishing process</li></ul>
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

# **MEM26020A Identify and interpret required standards for composites**

## **Modification History**

Release 1      New unit

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify a relevant standard for a job, such as an agreed quality assurance/quality control external standard, and take actions required to produce a product which complies with the standard. This can be more important for 'specials' where there is no agreed, standardised work process designed to deliver the required standard.

## **Application of the Unit**

This unit covers the identification and selection of relevant standards for a job as may be relevant to the redesign of an existing product (e.g. using a different process), the design of a new product similar to an existing product, or the undertaking of a repair.

Standard selection may typically be undertaken by an individual in liaison with relevant stakeholders or it may undertaken by a team. Selection may be undertaken in an office environment or at the worksite.

Use of the standard will be part of a fabrication and may be undertaken by an individual or a team. It may be undertaken in a workshop or factory environment or in the field and may be used to manufacture new products, prototypes and samples, or to make repairs.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Identify relevant standard                 | 1.1 | Review available standards                                    |
|   |  | 1.2 | Identify standard which may have relevance to the job         |
|   |  | 1.3 | Select the appropriate standard                               |
|   |  |     |   |
| 2 | Determine requirements to meet standard    | 2.1 | Interpret standard  |
|   |  | 2.2 | Identify application of standard to job                       |
|   |  | 2.3 | Compile specifications which will ensure job meets standard   |
|   |  |     |   |
| 3 | Undertake required work                    | 3.1 | Ensure procedures will produce a product which meets standard |
|   |  | 3.2 | Ensure any required testing/metrics gathering is undertaken   |
|   |  | 3.3 | Monitor production to ensure it complies with the procedures  |
|   |  | 3.4 | Minimise waste  |
|   |  |     |   |
| 4 | Check conformance to standard, as required | 4.1 | Check final product complies with the standard, as required   |
|   |  | 4.2 | Identify areas for improvement and take appropriate actions   |
|   |  | 4.3 | Complete any required documentation/reporting                 |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- creating documents to support quality control
- reading technical documentation
- interpreting technical documentation and applying to job
- developing required work procedures to conform to standard

### Required knowledge

Required knowledge includes:

- relevant standards
- interpretation of standards
- evidence to support meeting of standard
- accessing standards
- copyright of Australian Standards
- using standards

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that the process and equipment be understood and that the importance of critical material properties, settings and readings is known. Competence must be demonstrated in the ability to recognise and analyse potential situations requiring action and then in implementing appropriate corrective action.</p> <p>Consistent performance should be demonstrated. In particular look to see that:</p>
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	<ul style="list-style-type: none"> <li>• all reasonably relevant standards are considered</li> <li>• an appropriate standard is chosen</li> <li>• the reasons for choosing the standard are sound</li> <li>• the procedure delivers a product which meets the standard.</li> </ul> <p>Competence must be demonstrated in the operation of all ancillary equipment to the level required for this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>Assessment will require the selection of appropriate standards and monitoring jobs to ensure they comply with those standards.</p> <p>Assessment will occur over a range of situations which will include disruptions to normal, smooth operation.</p>
<b>Method of assessment</b>	<p>A single assessment event is not appropriate. On-the-job assessment should be included as part of the assessment process wherever possible. Where assessment occurs off the job, judgement must consider evidence of the candidate's performance in a productive work environment that includes a sufficient range of appropriate tasks and materials to cover the scope of application for this unit.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work

environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Procedures</b>	<p>Procedures may be written, verbal, computer-based or in some other form, and may include:</p> <ul style="list-style-type: none"> <li>• all work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions</li> <li>• any similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Responsible Care) and government regulations</li> </ul>
<b>Standards</b>	<p>Standards may include:</p> <ul style="list-style-type: none"> <li>• Australian Standards (AS)</li> <li>• International Standards Organisation (ISO)</li> <li>• original equipment manufacturer (OEM) specifications</li> <li>• Civil Aviation Safety Authority (CASA)</li> <li>• Department of Defence (DoD)</li> <li>• Australian Design Rules (ADR)</li> </ul>
<b>Logs and reports</b>	<p>Logs and reports may include:</p> <ul style="list-style-type: none"> <li>• paper or electronic based</li> <li>• verbal reports</li> <li>• items found which require action</li> </ul>
<b>Appropriate action</b>	<p>Appropriate action includes:</p> <ul style="list-style-type: none"> <li>• determining problems needing action</li> <li>• determining possible fault causes</li> <li>• rectifying problem using appropriate solution within area of responsibility</li> <li>• following through items initiated until final resolution has occurred</li> <li>• reporting problems outside area of responsibility to designated person</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• standard may not lead to practical procedure</li> <li>• compliance with standard may take precedence over</li> </ul>

	sustainability
<b>Health, safety and environment (HSE)</b>	All operations to which this unit applies are subject to stringent HSE requirements, which may be imposed through state/territory or federal legislation, and these must not be compromised at any time. Where there is an apparent conflict between Performance Criteria and HSE requirements, the HSE requirements take precedence

## Unit Sector(s)

Composites

## Custom Content Section

Not applicable.

## MEM30005A Calculate force systems within simple beam structures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers understanding and calculating force systems within simple beam structures.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to solving simple engineering problems involving forces, moments and basic stress and strain calculations, and determining nominal sizes of simple beams subject to loading.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine the resultant and equilibrant of systems of coplanar forces	<p>1.1. Calculate the magnitude and direction of the resultant and equilibrant of coplanar force systems.</p> <p>1.2. Calculate the line of action of a resultant using the principle of Moment.</p>
2. Determine nominal sizes for a simple horizontal beam subject to a combination of uniform and point loading	<p>2.1. Support reactions for a simply supported horizontal beam using the equations of equilibrium and including the moment effect of a couple are calculated.</p> <p>2.2. The possible types of failure that need to be considered are determined.</p> <p>2.3. Shear force and bending moment diagrams are drawn.</p> <p>2.4. Bending stress is determined.</p> <p>2.5. Calculations are completed to determine the nominal size for the beam.</p> <p>2.6. Factors of safety are applied to finalise nominal size of beam.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- calculating and using trigonometry, transposition, algebraic formula
- drawing shear force and bending moment diagrams

#### Required knowledge

Look for evidence that confirms knowledge of:

- force and gravity
- the concept of force
- characteristics of force
- rectangular components of force
- graphical addition of forces
- mathematical addition of forces
- weight as force
- moment and torque
- moment of force
- addition of moments
- equilibrium of moments
- torque
- equivalent force moment systems
- statics
- equilibrium of coplanar forces
- conditions of equilibrium
- calculation of beam reactions (simply supported, point load, uniformly distributed load (UDL), self-weight)
- simple beams
- shear force and bending moment diagrams
- bending stress
- deflection by formulae
- stress and strain
- shear stress and strain
- allowable stress
- factors of safety

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to calculate force systems within simple beam structures. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with calculating force systems within simple structures, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE****Guidance information for  
assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)****Unit sector**



## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30006A Calculate stresses in simple structures

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers determining stresses and their effect on the strength and stability of simple structures and mechanical components.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the calculation of stresses in centrally loaded bolted connections, fillet and butt welded connections.</p> <p>All work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM30012A	Apply mathematical techniques in a manufacturing engineering or related environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine stresses in simple structures and mechanical components	<p>1.1.The shear stresses in simple bolted connections are determined.</p> <p>1.2.The nominal weld size or length of weld required on simple welded connections is determined to meet load requirements.</p> <p>1.3.Torque distribution diagrams are drawn and used to calculate torsional shear stress and angle of twist on threaded bolts subjected to torques.</p>
2. Verify stress levels using appropriate reference material	<p>2.1.Appropriate reference materials are used to verify that stress loading is acceptable and in accordance with standard operational procedures.</p> <p>2.2.Verification results are reported according to standard operational procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

**REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

Look for evidence that confirms skills in:

- interpreting drawings and graphical representations
- calculating stresses using given formulas
- construction of torque distribution diagrams
- accessing relevant codes and reference material
- interpreting results against reference materials

**Required knowledge**

Look for evidence that confirms knowledge of:

- stress and strain:
  - normal stress and strain
  - modules of elasticity
  - deformation
  - Poisson's Ratio
  - shear stress and strain
  - modulus of rigidity
  - yield stress, ultimate stress, proportional limit, factor of safety, allowable stress
- centrally loaded connections
- bolted connections
- shear, tensile, torque and bearing stresses
- centrally loaded welded connections
- fillet and butt welds, method of failure
- size and length of weld
- effect of hole punching
- longitudinal stress
- how to access and use relevant codes and reference material

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

**EVIDENCE GUIDE**

Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to calculate stresses in simple structures as defined. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with calculating stresses in simple structures, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment**

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Simple structures</b>	Limited to consideration of centrally loaded bolted connections, fillet and butt welded connections
<b>Reference materials</b>	May include design manuals, handbooks, relevant codes and regulations, databases and manufacturers' references

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30007A Select common engineering materials

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers recognising common materials used in engineering, assisting in the selection of a material for a specific application, and using test results to evaluate the properties of materials.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to technician level activities in manufacturing and engineering environments.</p> <p>Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify common engineering materials by their principal properties	1.1.The principal properties of ferrous and non-ferrous metals are identified. 1.2.The principal properties of thermosetting and thermoplastic polymers are identified. 1.3.The principal properties of ceramics and composite materials are identified. 1.4.The effects of different types of bonding in materials are identified. 1.5.The effects of mechanical and thermal processes on the principal properties of materials are identified.
2. Select materials for specific applications	2.1.The engineering requirement for the specific application is determined in consultation with others. 2.2.Material is selected based on the requirement and consideration of principal properties and further processing. 2.3.Selection is confirmed according to standard operating procedures.
3. Verify selected material as fit for purpose	3.1.Appropriate tests for the required properties are identified. 3.2.Testing of materials is arranged with appropriate persons, if necessary. 3.3.Test results are analysed and material choices are

ELEMENT	PERFORMANCE CRITERIA
	confirmed or modified as appropriate.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking research
- selecting/carrying out tests appropriate to the material
- communicating
- documenting
- planning and sequencing operations
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents

#### Required knowledge

Look for evidence that confirms knowledge of:

- classification of materials:
  - metals and non-metals
  - ferrous and non-ferrous metals
  - polymers (thermoplastics, thermosetting and elastomers)
  - ceramics
  - composite materials
- structure of materials
- physical properties of materials:
  - electrical conductivity/resistivity
  - specific gravity/density
  - thermal conductivity/expansion
  - specific heat
  - melting/boiling points
- magnetic properties
- optical properties
- mechanical properties:

**REQUIRED SKILLS AND KNOWLEDGE**

- strength - yield, tensile, compressive
- stress/strain data
- hardness
- toughness (impact and slow strain)
- elasticity
- plasticity
- ductility
- malleability
- fatigue
- creep
- chemical properties:
  - corrosion of metals, corrosion processes, mechanisms
  - degradation of polymers
- materials testing methods - destructive testing and applications:
  - tensile
  - compressive
  - shear
  - torsion
  - hardness
  - impact
  - fatigue
  - creep
  - visual
  - corrosion testing
- engineering materials
- engineering applications of ferrous metals:
  - cast irons
  - carbon and alloy steels
  - stainless steels
- engineering applications of non-ferrous metals:
  - aluminium and its alloys
  - copper, brass and bronze
  - nickel alloys, zinc, titanium
  - magnesium
  - refractory metals
- engineering applications of polymers:
  - thermosetting polymers
  - thermoplastic polymers

## REQUIRED SKILLS AND KNOWLEDGE

- ceramics and glasses
- effects of mechanical and thermal processes on the properties of materials:
  - casting
  - forging, rolling and extrusion
  - cold forming
  - powder processes
  - heat treatment
  - joining - fasteners
  - soldering
  - brazing
  - welding
  - adhesives
  - finishing - coatings, metallic and non-metallic
- hazards and control measure associated with selecting common engineering materials, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to select common engineering materials.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this

**EVIDENCE GUIDE**

	<p>unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting common engineering materials, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Common engineering materials**

Includes ferrous metals, cast irons, carbon and alloy steels, stainless steels, coated steels, non-ferrous metals, aluminium and its alloys, copper and its alloys, nickel alloys, zinc, titanium, magnesium, refractory metals, polymers,

<b>RANGE STATEMENT</b>	
	thermosetting polymers, thermoplastic polymers, ceramics and glasses
<b>Appropriate tests</b>	Tests which can be undertaken by a technician within the organisation as well as those required to be undertaken by external organisations, including simple tests
<b>Required properties</b>	Properties to be tested include tensile strength, compression, shear characteristics, torsion, hardness, impact resistance, fatigue resistance, creep resistance, visual appearance and colour, magnetic properties, corrosion resistance
<b>Appropriate persons</b>	Internal technicians and/or external organisations

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30008A Apply basic economic and ergonomic concepts to evaluate engineering applications

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers participating in the application of the basic concepts of economic and ergonomic principles and procedures to evaluate an engineering application prior to production.
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### Application of the Unit

<b>Application of the unit</b>	<p>The work is carried out under supervision, usually in a team environment.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare required customer requirements from information provided	Criteria for the engineering application are obtained in accordance with standard operating procedures.
2. Verify that customer requirements have been met in the engineering application criteria	<p>Criteria for the engineering application criteria are reviewed against customer requirement and deficiencies are noted.</p> <p>Knowledge of engineering parameters is applied to evaluate the engineering application criteria.</p> <p>Use of appropriate and relevant standards and codes is verified using standard operating procedures or reference to supervisor.</p>
3. Verify specifications in accordance with economic principles	The relationships between quality, cost of production and function are considered and specifications are verified in accordance with policy and procedures.
4. Verify specifications in accordance with ergonomic principles	The specifications are checked and verified for health effects of human/machine interaction in accordance with given policy and procedures.
5. Seek approval of recommendations	All recommendations are referred to a supervisor for approval in accordance with policy and procedures.



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- determining customer requirements
- determining, accessing and using relevant Australian and ISO standards

#### Required knowledge

Look for evidence that confirms knowledge of:

- engineering parameters:
  - safety of personnel, consequences of failure (such as human injury)
  - quality of product consideration
  - material reliability and choice
  - safety factors
  - maintenance, source of spares/service
  - energy consumption
- economic considerations:
  - costs of manufacture, effect of production quantity
  - cost of quality
  - design for manufacture
  - use of standardised components
- ergonomic considerations:
  - safety considerations
  - human capacity - reach, dexterity, strength, human comfort
  - health effects of human/machine interaction, repetitive use injuries
  - aesthetics

## Evidence Guide

### EVIDENCE GUIDE

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to participate in the application of basic economic, ergonomic concepts to evaluate engineering designs and applications.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic economic, ergonomic concepts to engineering designs and applications, or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

## EVIDENCE GUIDE

### Guidance information for assessment

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Engineering application

For this unit, engineering application includes assisting in engineering processes and applications requiring ergonomic and economic knowledge and skills including design, engineering assessments, supervision of installation and commissioning etc.

#### Engineering parameters

Includes consideration of safety of personnel, consequences of failure (human injury etc.), economic considerations, production cost, quality of product consideration, material reliability and choice, design safety factors, maintenance, energy consumption, source of spares/service

#### Standards and codes

Includes access and use of Australian standards (AS): AS 3000, AS 1250, AS 4800, AS 1100, International Standards Organisation (ISO) standards

#### Economic principles

Includes production quantities (mass/batch), cost of manufacture, ease of manufacture, use of standardised components, human capacity (reach, dexterity, strength, repetitiveness, human comfort), aesthetics, health effects of human/machine interaction, safety

#### Ergonomic principles

Includes designing, installing or checking things for effective human use, and creating environments that are suitable for human living

RANGE STATEMENT	
	and work. It includes work methods, equipment, facilities, and tools that influence the worker's motivation, fatigue, likelihood of sustaining an occupational injury or illness, and productivity

## Unit Sector(s)

Unit sector	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30009A Contribute to the design of basic mechanical systems

### Modification History

Release 2 - Prerequisites updated - MEM30002A and MEM30003A merged and replaced in MEM05v8 by MEM30032A. Prerequisite outcomes remain equivalent.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers contributing to basic mechanical system design, and selecting the components and mechanical features required to perform simple functions.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all mechanical engineering environments. Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16008A	Interact with computing technology
	MEM30032A	Produce basic engineering drawings

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research equipment function and operational requirements	<p>1.1.All relevant drawings, specifications, manuals and documentation are obtained in accordance with workplace procedures.</p> <p>1.2.Appropriate personnel are consulted to determine requirements.</p> <p>1.3.Information collected is interpreted and draft functional and operational requirements are prepared and verified with supervisor or design team.</p>
2. Prepare a preliminary sketch/drawing/specification	<p>2.1.Appropriate components, assemblies and fasteners are selected to perform the required function.</p> <p>2.2.Where required, components and/or materials are selected from supplier/manufacturer catalogues.</p> <p>2.3.Appropriate and relevant codes are applied to the sketch/drawing/specification in accordance with workplace procedures.</p> <p>2.4.The preliminary sketch/drawing/specification is referred to a higher authority for approval in accordance with policy and procedures.</p>
3. Issue or file completed sketch/drawing/specification	<p>3.1.Approved sketch/drawing/specification is stored and catalogued in accordance with standard</p>

ELEMENT	PERFORMANCE CRITERIA
ion list as required	<p>operating procedures.</p> <p>3.2. Approved sketch/drawing/specification is issued in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- reading and interpreting specifications and drawings

#### Required knowledge

Look for evidence that confirms knowledge of:

- relevant codes and standards
- basic mechanical components:
  - shafts
  - bearings
  - seals
  - fasteners, thread systems
  - splines
  - cams
- drive components:
  - electric motors
  - IC engines
  - brakes
  - clutches
  - belts and pulleys
  - chains and sprockets
  - gears
  - couplings
  - universal joints
- lifting systems:

## REQUIRED SKILLS AND KNOWLEDGE

- lifting jacks
- hoists
- winch equipment
- pneumatic systems:
  - advantages and disadvantages
  - compressors
  - pneumatic components
  - typical circuits and applications
  - electrical control
- hydraulic systems:
  - advantages and disadvantages
  - power packs
  - pumps and other components
  - typical circuits and applications
  - electrical control
- pumps and piping system:
  - purpose of pumps and piping systems
  - pumps, valves, pipes and other components
  - typical piping systems

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to contribute to the design of basic mechanical systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.



**EVIDENCE GUIDE****Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with contributing to the design of basic mechanical systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and

**RANGE STATEMENT**

regional contexts) may also be included.

**Components, assemblies and fasteners**

May include shafts, seals, bearings, fasteners, splines, cam, lifting systems, pneumatic circuits, hydraulic circuits, piping systems

**Unit Sector(s)****Unit sector****Co-requisite units****Co-requisite units****Competency field****Competency field**

Engineering technician

## MEM30010A Set up basic hydraulic circuits

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up and selecting components associated with single linear hydraulic systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all engineering or manufacturing environments.</p> <p>The unit refers to simple hydraulic circuits containing single linear actuators and motors.</p> <p>Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine system requirements	<p>1.1. Instructions regarding system requirements are obtained, understood and clarified as necessary.</p> <p>1.2. Circuit drawings using standard symbols are interpreted correctly.</p>
2. Select components for simple hydraulic circuits	<p>2.1. Suitable fluids are selected for given hydraulic systems from specification charts and in accordance with safety procedures involving fluids.</p> <p>2.2. Linear actuators and motors are selected to suit system requirements.</p> <p>2.3. Control valves are selected to suit system requirements.</p>
3. Verify component selection	<p>3.1. Circuits are set up and operated on laboratory benches.</p> <p>3.2. Operation is analysed and outcomes are verified against system requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- interpreting simple hydraulic circuit drawings
- testing operation of simple hydraulic circuits
- assessing performance
- documenting circuit specifications and test results
- applying fluid power principles

### Required knowledge

Look for evidence that confirms knowledge of:

- fluid power:
  - definition of the term fluid power
  - differences between pneumatic and hydraulic systems
  - advantages and disadvantages of fluid power compared with mechanical and electric power systems
  - safety procedures when working with fluid power equipment
  - basic properties of fluids
  - selection and suitability for different applications
  - basic properties and units - mass, volume, density, specific volume, relative density, force and weight, pressure (absolute, atmospheric and gauge), temperature (celsius and kelvin), viscosity, surface tension
  - introduction to temperature and pressure effects on the basic properties and applications
  - precautions to be taken when changing type of fluid in a system
- awareness of different components including:
  - pipes (rigid and flexible)
  - valves, types and functions
  - filters and strainers for liquids
  - gauges and instruments - pressure/temperature gauges, liquid level gauges, thermometers, thermocouples, manometers, piezometers
  - pipe fittings - elbows/bends, enlargement/contractions, coupler/unions, tees
  - tanks and vessels - storage tanks, pressure vessels, header and surge tanks, weirs/dams/reservoirs
  - flow measurement instruments - venturi and orifice meters
  - pumps, motors/turbines
  - linear actuators:

**REQUIRED SKILLS AND KNOWLEDGE**

- types, selection and functions
- methods of supporting linear actuators
- introduction to calculations related to linear actuators
- recognition and drawing of standard symbols
- observation and analysis of performance of linear actuators in laboratory circuits
- control valves (hydraulic and pneumatic):
  - directional controls and functions
  - check valves and functions
  - pressure controls and functions
  - flow controls and functions
  - recognition and drawing of standard symbols for control valves
  - drawing and analysis of typical circuits containing control valves
  - observation and analysis of performance of valves in basic circuits
- circuit design and analysis (single linear actuator):
  - drawing and analysis of circuit diagrams containing basic components
  - setting up and operating circuits on pneumatic and hydraulic benches in a fluid power laboratory

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to set up basic hydraulic circuits and verify outcomes.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the

<b>EVIDENCE GUIDE</b>	
	<p>job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting up basic hydraulic circuits, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Simple hydraulic circuits</b>	Limited to linear actuators, motors, control valves

**RANGE STATEMENT**

<b>Safety procedures</b>	Selecting a suitable fire resistant fluid for a system, given its operating conditions; following required precautions when changing a system from one fluid to another
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**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Engineering technician
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## MEM30011A Set up basic pneumatic circuits

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers setting up and selecting components associated with single linear pneumatic systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all engineering or manufacturing environments.</p> <p>The unit refers to simple pneumatic circuits containing single linear actuators.</p> <p>Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine system requirements	<p>1.1. Instructions regarding system requirements are obtained, understood and clarified as necessary.</p> <p>1.2. Circuit drawings using standard symbols are interpreted correctly.</p>
2. Select components for simple pneumatic circuits	<p>2.1. Suitable air system components are selected for given fluid power systems from specification charts and in accordance with safety procedures involving compressed air.</p> <p>2.2. Linear actuators are selected to suit system requirements.</p> <p>2.3. Control valves are selected to suit system requirements.</p>
3. Verify component selection	<p>3.1. Circuits are set up and operated on laboratory benches.</p> <p>3.2. Operation is analysed and outcomes are verified against system requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- drawing pneumatic circuits
- testing operation of pneumatic circuits
- assessing performance
- calculating circuit requirements
- documenting circuit specifications and test results
- applying fluid power principles

#### Required knowledge

Look for evidence that confirms knowledge of:

- fluid power:
  - definition of the term fluid power
  - differences between pneumatic and hydraulic systems
  - advantages and disadvantages of fluid power when compared to mechanical and electric power systems
  - safety procedures when working with compressed air and associated equipment
- awareness of different components including:
  - air compressors
  - receivers, interlocks
  - pipes - rigid and flexible
  - valves - types and functions
  - filters - types and functions
  - gauges and instruments - pressure and temperature gauges, liquid level gauges, thermometers, thermocouples, manometers, piezometers
  - pipe fittings - elbows/bends
  - flow measurement instruments - venturi and orifice meters
  - air motors
  - linear actuators:
    - types, selection and functions
    - methods of supporting linear actuators
    - introduction to calculations related to linear actuators
    - recognition and drawing of standard symbols
    - observation and analysis of performance of linear actuators in laboratory circuits

**REQUIRED SKILLS AND KNOWLEDGE**

- control valves (hydraulic and pneumatic):
- directional controls and functions
- check valves and functions
- pressure controls and functions
- flow controls and functions
- recognition and drawing of standard symbols for control valves
- drawing and analysis of typical circuits containing control valves
- observation and analysis of performance of valves in basic circuits
- circuit design and analysis (single linear actuator):
  - drawing and analysis of circuit diagrams containing basic components
  - setting up and operating circuits on pneumatic and hydraulic benches in a fluid power laboratory

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to set up basic pneumatic circuits.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with setting up basic pneumatic circuits or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Safety procedures</b>	Following required precautions when using compressed air and when shutting down air compressors and receivers

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Engineering technician
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## MEM30012A Apply mathematical techniques in a manufacturing engineering or related environment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applies the <i>concepts of mathematics</i> to appropriate and simple engineering situations within the individual's area of engineering expertise.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to technician level work that requires basic algebraic, trigonometric and statistical knowledge and skill.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 4</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use concepts of arithmetic in the solution of engineering problems	<p>1.1.Units of physical quantities are converted to facilitate engineering calculations.</p> <p>1.2.Calculations are performed to solve problems involving rational and irrational numbers.</p> <p>1.3.Scientific notation is used to represent numbers.</p> <p>1.4.Calculations are checked for reasonableness using estimating and approximating techniques.</p>
2. Solve engineering problems involving algebraic expressions with one independent variable	<p>2.1.Algebraic expressions are manipulated using mathematical operations in their correct order.</p>
3. Use two-dimensional geometry to solve practical problems	<p>3.1.Angles expressed in degrees are correctly converted to radians and vice versa.</p> <p>3.2.The perimeter, area, length and angles of a range of two-dimensional figures are correctly calculated.</p> <p>3.3.The volume and surface area of complex figures are correctly calculated.</p> <p>3.4.Points identified in terms of cartesian coordinates can be converted to polar coordinates and vice versa.</p>
4. Use trigonometry to solve practical	<p>4.1.Basic trigonometry functions are used to calculate the lengths of the sides of right-angled triangles.</p>



ELEMENT	PERFORMANCE CRITERIA
problems	<p>4.2. Inverse trigonometry functions are used to determine angles in a right-angled triangle given the lengths of two sides.</p> <p>4.3. The sine rule is used to determine the lengths of the sides of acute and obtuse angled triangles given one side and two angles.</p> <p>4.4. The cosine rule is used to determine the lengths of the sides of acute and obtuse angled triangles given two sides and one angle.</p>
5. Graph linear functions	<p>5.1. Linear functions are solved graphically and equations of straight lines are determined from the slope and one point, or two points.</p> <p>5.2. Two linear functions are solved simultaneously both algebraically and geometrically.</p> <p>5.3. The length and mid point of a line segment are determined.</p>
6. Solve quadratic equations	<p>6.1. Quadratic equations are solved.</p> <p>6.2. Simultaneous linear and quadratic equations are solved.</p>
7. Perform basic statistical calculations	<p>7.1. Mean, median and mode are calculated from given data.</p> <p>7.2. Standard deviation is calculated and interpreted employing graphical representation.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using and applying mathematical formulas:
  - logical thinking
  - problem solving
  - calculating
  - applying statistics

## REQUIRED SKILLS AND KNOWLEDGE

- using computer numerical methods
- drawing graphs

## Required knowledge

Look for evidence that confirms knowledge of:

- transposing and evaluating formulae
- polynomials
- straight line coordinate geometry
- introduction to indices
- introduction to trigonometry
- circular functions
- trigonometry of oblique triangles
- trigonometric identities
- introduction to functions and their graphs

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to apply mathematical skills and knowledge to simple engineering applications. Evidence from tasks and projects should/may be used to complement and demonstrate integration of competency.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic

<b>EVIDENCE GUIDE</b>	
	<p>workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying mathematical concepts to engineering applications, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Concepts of mathematics</b>	<p>Include arithmetic, algebraic expressions with one independent variable, two-dimensional geometry, trigonometry, linear functions, basic quadratic functions, basic statistical methods</p>

## RANGE STATEMENT

<b>Correct order</b>	Refers to the correct procedure when expanding brackets, factorising algebraic expressions, factorising quadratic expressions, simplifying algebraic fractions, transposing formulae, solving simple one variable equations, finding the quotient and remainder given a linear division
<b>Complex figures</b>	May include cones, pyramids, spheres, frustums and intersections of figures singularly or in combination

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30013A Assist in the preparation of a basic workplace layout

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assisting in the charting and analysis of basic manufacturing operations including assisting in the preparation of workplace layouts.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit covers basic principles of ergonomics, productivity improvements and quality procedures and work flow analysis.</p> <p>Work is conducted under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify opportunities for workplace layout improvement	<ul style="list-style-type: none"><li>1.1. Basic analysis of workplace data is undertaken to determine sources of waste.</li><li>1.2. Future capacity requirement is obtained in accordance with policy and procedures.</li><li>1.3. Productivity improvement areas are established in accordance with organisational policy and procedures.</li><li>1.4. Appropriate productivity measures are established in conjunction with supervisors and other appropriate personnel.</li></ul>
2. Develop basic layout options for workplace improvement	<ul style="list-style-type: none"><li>2.1. Operation process charts, flow charts, flow process charts, and string diagrams etc. are used to develop basic layout options.</li><li>2.2. Information on ergonomics, health and safety hazards is considered in accordance with policy and procedures.</li><li>2.3. Improvements are developed in consultation with users and supervisors and in accordance with policy and procedures.</li><li>2.4. Simple economic appraisals for proposed improvements are developed in accordance with</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	policy and procedures. 2.5.Layout options are referred to a higher authority for approval in accordance with policy and procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating
- analysing
- documenting
- reviewing
- applying principles of ergonomics
- applying productivity principles

#### Required knowledge

Look for evidence that confirms knowledge of:

- basic knowledge of workplace layout principles including at a basic level the degree to which workplace layout is affected by:
  - engineering processes and systems
  - materials flow patterns
  - types of production plant and machinery
  - materials handling methods
  - unit loads
  - types of production methods
- productivity:
  - definition and measures of productivity
  - factors affecting productivity
  - productivity and quality
  - value adding
- recording techniques:
  - flow charts

**REQUIRED SKILLS AND KNOWLEDGE**

- activity relationship charts
- outline process charts
- flow process charts
- multipurpose charts
- string diagrams
- basic principle of ergonomics
- the concept of waste and its application to productivity improvements

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to assist in the design of basic workplace layout.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in the design of basic workplace layout, or other units requiring the exercise of the skills and knowledge covered by this unit.



**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Waste**

- Excess production and early production, waiting, materials queuing, not moving, people not working, transporting, double handling, poor process design, inventory, stores, buffers, lot sizes, inefficient performance of a process, reaching, bending, exertion
- Making defective items, rework, rejects, unnecessary inspection

**Information on ergonomics, health and safety hazards**

- Standard references including NOHSC guidelines, any relevant Acts and Regulations, information contained in manufacturers' manuals, standard operating procedures
- Workplace reports including: incident reports, commissioned studies, advice from relevant leaders/supervisors/workplace committees

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Engineering technician
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## MEM30014A Apply basic just in time systems to the reduction of waste

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers reviewing and making continuous improvements to an existing Just in Time (JIT) production system in manufacturing.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all types of manufacturing and engineering environments, most likely in a team setting. All work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify potential to eliminate waste in the current system	1.1.Value chain members are identified. 1.2.Principles of waste elimination are applied to each step in the value chain. 1.3.Current storage/inventory in value chain is analysed for excesses. 1.4.Production lead time is analysed for all components, sub-assemblies and assemblies subject to JIT including potential for set up time reductions. 1.5.Kanban cards and flow authorisation indicators are analysed for appropriate quantity. 1.6.Workplace layout is analysed for flow and application of housekeeping principles. 1.7.Production process is analysed for excess rework and scrap.
2. Draft workable procedures to implement improvements to JIT system	2.1.Key internal stakeholders are liaised with to develop solutions to JIT issues. 2.2.Key external members of the value chain are liaised with to develop solutions to JIT issues. 2.3.Key measures for improvements are determined. 2.4.The plan is referred to a higher authority for approval in accordance with policy and procedures.
3. Implement the JIT	3.1.The JIT system/improvements are implemented

ELEMENT	PERFORMANCE CRITERIA
system/improvements	according to workplace procedures. 3.2.Key measures of JIT are monitored. 3.3.Regular liaison is conducted with key stakeholders seeking areas for improvement.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- analysing
- communicating
- negotiating
- reading/interpreting/following information on written job instructions, specifications, standard operating procedures and other applicable reference documents
- planning and sequencing operations

#### Required knowledge

Look for evidence that confirms knowledge of:

- JIT manufacturing philosophy
- push and pull systems
- Kanbans
- work cells
- set up time reduction techniques
- group technology
- ABC analysis of inventory
- principles of TQM
- principles of TPM
- hazards and control measures associated with applying basic JIT systems to the reduction of waste
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply basic JIT systems to the reduction of waste.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic JIT systems to the reduction of waste or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Value chain</b>	Includes the entire production system, beginning with the customer, and includes the sales outlet, product design, processing and supply
<b>Waste</b>	<ul style="list-style-type: none"> <li>Includes activities and results to be eliminated within manufacturing</li> <li>Categories of waste include excess production and early production, waiting, materials queuing, not moving, people not working, transporting, double handling, poor process design, inventory, stores, buffers, lot sizes, inefficient performance of a process, reaching, bending, exertion, making defective items, rework, rejects, unnecessary inspection</li> </ul>
<b>JIT</b>	<ul style="list-style-type: none"> <li>Includes a production scheduling concept that calls for any item needed at a production operation - whether raw material, finished item, or anything in between, to be produced and available precisely when needed</li> <li>JIT systems may also be known as part of other manufacturing systems such as lean manufacturing, agile manufacturing or similar</li> </ul>
<b>Kanban</b>	<ul style="list-style-type: none"> <li>Includes a card or sheet used to authorise production or movement of an item</li> <li>Kanban is typically applied to batch type operations and the production is measured in units produced. In continuous manufacturing organisations, production is measured in terms of production rate</li> </ul>
<b>Flow authorisation indicator</b>	May include Kanban bin, ticket or similar, or may be some other indicator of demand pull

<b>RANGE STATEMENT</b>	
<b>Housekeeping principles</b>	<p>Principles of 5S which refer to the five Japanese words seiri, seiton, seison, seiketsu, shitsuke. These words are shorthand expressions for principles of maintaining an effective, efficient workplace:</p> <ul style="list-style-type: none"> <li>• seiri - eliminating everything not required for the work being performed</li> <li>• seiton - efficient placement and arrangement of equipment and material</li> <li>• seison - tidiness and cleanliness</li> <li>• seiketsu - ongoing, standardised, continually improving seiri, seiton, seison</li> <li>• shitsuke - discipline with leadership</li> </ul>
<b>Key measures</b>	<ul style="list-style-type: none"> <li>• May include inventory levels, lead time, delivery, productivity/ production rate, set up time, other measures of pull through the value chain, quality, rework, scrap rates</li> <li>• Pull system refers to a manufacturing planning system based on actual real-time needs from sales or equivalent - i.e. 'make what we sell'</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>	



## Competency field

Competency field	Engineering technician
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## MEM30015A Develop recommendations for basic set up time improvements

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers participating in the development of improved set up procedures in manufacturing.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all fields of manufacturing. Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify existing set up procedures	1.1.Internal and external set up activities are identified and recorded. 1.2.All waiting time is identified and recorded. 1.3.All adjustment times are identified and recorded. 1.4.Any hazards and risks from all steps in the set up are identified and recorded.
2. Analyse set up procedures to determine opportunities for improvement	2.1.Opportunities for conversion of internal set up activities to external set up are considered. 2.2.Opportunities to reduce/eliminate adjustment times, waiting times and any hazards and risks are considered.
3. Prepare recommendations for operational improvement	3.1.Liaise with relevant people to validate recommendations. 3.2.Recommended improvements are recorded.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- communicating, including preparing reports
- analysing hazards
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures and other applicable reference documents

### Required knowledge

Look for evidence that confirms knowledge of:

- principles of set up time reduction including:
  - internal and external set up activities
  - waiting time
  - adjustment times
  - set up hazards and risks
- planning and sequencing operations:
  - application of ergonomic principles and hierarchy of control in regard to hazards
  - hazards and control measures associated with developing recommendations for basic set up time improvements, including housekeeping
  - safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to develop recommendations for basic set up time improvements.

#### Critical aspects for assessment and evidence required to demonstrate

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the

<b>EVIDENCE GUIDE</b>	
<b>competency in this unit</b>	unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing recommendations for basic set up time improvements, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised

**RANGE STATEMENT**

wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Set up procedures**

May refer to:

- an exchange of dies/tools or a change between batches
- any quantum equipment/process change to produce a different product

**Internal and external set up activities**

- Internal set up activities are those that can be done only when the machine or process is not actively engaged in production
- External set up activities are those that can be done concurrently when the machine or process is actively engaged in production

**Waiting time**

Includes clean up activities, waiting for tools, waiting for materials, waiting for instructions, waiting for approvals, operator training etc.

**Unit Sector(s)****Unit sector****Co-requisite units**

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30016A Assist in the analysis of a supply chain

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assisting in the analysis of value adding and non value adding activities within the supply chain.
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### Application of the Unit

<b>Application of the unit</b>	<p>The unit applies to all fields of engineering and manufacture. The skills defined by this unit would normally be exercised under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assist in mapping the supply stream for a nominated product/process	1.1.All organisations in the supply stream are identified. 1.2.All relevant steps in own organisation are identified.
2. Assist in assessing the value added at each step	2.1.Value added and contributed by each supplier organisation is identified. 2.2.Value added by each internal step is identified. 2.3.Activities which do not add value to customer benefit/features are identified. 2.4.External/internal supply chain members are liaised with to identify methods to reduce non value adding activities. 2.5.Information is collated and assessed. 2.6.Suggestions for improvements are recorded and submitted for approval.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- communicating
- planning
- assessing
- problem solving
- analysing
- prioritising
- reading and interpreting
- recording

### Required knowledge

Look for evidence that confirms knowledge of:

- purpose of supply chain analysis
- methods of supply chain analysis
- types of waste, non value adding activities and methods of reducing them
- process used to make own product
- processes employed by other members of the supply chain sufficient to have meaningful dialogue with them
- safe work practices

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to assist in the analysis of a supply chain.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency

<b>EVIDENCE GUIDE</b>	
	in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in the analysis of a supply chain, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work</p>

<b>RANGE STATEMENT</b>	
situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Supply stream</b>	Encompasses the entire supply system, beginning with the raw materials, processing and all tiers of the supply chain
<b>Value added</b>	Is measured against its contribution to the customer benefits/features and is determined in accordance with company definitions
<b>Non value adding activities</b>	Includes excess production and early production, delays, movement and transport, poor process design, inventory, inefficient performance of a process and making defective items

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30017A Use basic preventative maintenance techniques and tools

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers supporting the implementation of a preventative maintenance strategy for a manufacturing enterprise.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit may apply to a range of predictive or proactive maintenance strategies within a manufacturing environment. The unit covers skills to enable participation across the most common preventative maintenance strategies and introduces the most common techniques and statistical tools. All work is undertaken under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Interpret enterprise maintenance strategy	1.1.Objectives and details of enterprise maintenance strategy are obtained in accordance with enterprise procedures. 1.2.Major techniques and tools for monitoring are confirmed in consultation with key stakeholders and supervisor.
2. Use preventative maintenance techniques and tools	2.1.Techniques and tools are selected and confirmed in consultation with key stakeholders and supervisor in accordance with enterprise requirements. 2.2.Key information and performance indicators required are identified in consultation with key stakeholders and supervisor. 2.3.Data collection is undertaken as required.
3. Interpret results	3.1.Actual information/performance indicators are compared with target levels set by supervisors and/or equipment manufacturers. 3.2.Required adjustments are developed in consultation with key stakeholders and supervisor.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- conducting root cause analysis
- identifying mean time between failures
- basic analysis of the effects of failures
- conducting condition monitoring
- analysing
- assessing
- communicating
- problem solving
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking for conformance to specifications
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- characteristics and strengths of different types of strategies
- characteristics and strengths of different types of techniques and tools
- principles of process equipment and how to improve its reliability
- resources required and how to obtain them
- hazard and control measures associated with using basic preventative maintenance techniques and tools, including housekeeping
- use and application of personal protective equipment
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use basic preventative maintenance techniques and tools.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using basic preventative maintenance techniques and tools, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Strategies</b>	May include total productive/preventive maintenance, reliability centred maintenance
<b>Techniques and tools</b>	Includes root cause analysis, mean time between failures, failure modes effects analysis, condition monitoring not involving application of trade skills

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30018A Undertake basic process planning

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers undertaking a basic determination of process specifications and production sequence for a manufacturing operation.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a range of processes in manufacturing and to a stage of the overall production process. It does not apply to interfacing between processes.</p> <p>The process plan is developed over a specified timeframe taking into account resources available and required. The process plan establishes detailed steps required, and milestones against which progress can be checked. The plan is developed in accordance with accepted organisation practice and procedures.</p> <p>Performance of this unit would normally be conducted in a work environment where the basic process plan is reviewed by supervisors, planners or other internal review procedures before the plan is implemented.</p> <p>Where interfacing between manufacturing processes is required, Unit MEM30021A (Prepare a simple production schedule) should be selected.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assist in determination of a process sequence	<p>1.1.A basic analysis of process specifications using relevant job instructions, drawings, cost objectives, and operational procedures is undertaken.</p> <p>1.2.An operation or process sheet is prepared based on analysis.</p> <p>1.3.The process steps are clearly documented and approved in accordance with standard operating procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.4.Flow charts, based on analysis, are produced where required.</p> <p>1.5.Material and parts lists are prepared, based on analysis, for the production process in accordance with standard operating procedures.</p> <p>1.6.Tooling and/or equipment requirements are determined in conjunction with supervisor and other expert personnel.</p> <p>1.7.All requirements are documented in accordance with standard operating procedures.</p>
2. Prepare and submit new/revised operation sheet/flow chart/parts list as required	<p>2.1.New/revised operation sheet/flow chart/parts list is prepared in accordance with standard operating procedures.</p> <p>2.2.New/revised operation requirements are submitted in accordance with enterprise approval procedures.</p>
3. Issue or file approved operation sheet/flow chart/parts list as required	<p>3.1.Approved drawings and or parts lists are stored and catalogued or issued in accordance with standard operating procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating
- prioritising
- planning
- drawing
- evaluating
- analysing
- documenting
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures charts, lists, drawings and other applicable reference documents.

**REQUIRED SKILLS AND KNOWLEDGE**

- planning and sequencing operations
- checking and clarifying task-related information

**Required knowledge**

Look for evidence that confirms knowledge of:

- overview knowledge of product and process manufacturing principles including:
  - flow
  - elaborate transformation
  - value adding
  - waste
  - hazard identification and reduction
  - safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to undertake basic process planning.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with undertaking basic process planning, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Operation or process sheet</b>	Includes operation sheets, sketches, tooling, equipment schedules and gauges etc.

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30019A Use resource planning software systems in manufacturing

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers accessing and using Enterprise Resource Planning (ERP), Materials Requirement or Resource Planning (MRP) software systems in conjunction with Just in Time techniques.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to resource planning software systems. Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM16008A	Interact with computing technology

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Use software interface	1.1.Keyboards, track ball/mouse and monitor and/or other peripherals are used to access system. 1.2.The system and the screens are navigated. 1.3.Messages are acknowledged. 1.4.Information is processed in the required format.
2. Access information	2.1.Relevant data and information is obtained from the system. 2.2.The status of items in the system is identified. 2.3.Historical data and information are accessed. 2.4.Information is interpreted and actions are prioritised.
3. Take appropriate actions	3.1.Actions are taken in response to resource planning information. 3.2.Follow-up is conducted as appropriate to ensure anticipated results have occurred. 3.3.Adjustments and variations are recorded according to procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using basic computer functions
- analysing
- communicating
- undertaking production planning and control
- prioritising
- reading and interpreting
- recording

#### Required knowledge

Look for evidence that confirms knowledge of:

- technical knowledge and skills needed to operate process
- hierarchy of ERP, MRP or similar systems and operation
- information available from and business activities exercised by/through the ERP, MRP system
- closed loop manufacturing system basics
- business planning, demand, resources
- Master Production Scheduling (MPS)
- Materials Requirement Planning (MRP)
- Capacity Requirement Planning (CRP)
- system inputs:
  - bills of material
  - need for accuracy
  - inventory statistics
  - planning data
  - introduction to capacity management
  - production activity control
- system outputs:
  - planned orders
  - order action
  - firm/tentative
- Just in Time (JIT)
  - techniques
  - production smoothing

**REQUIRED SKILLS AND KNOWLEDGE**

- single unit flow
- Kanban
- set up time reduction (SMED)
- lead time reduction
- production control methods:
  - types
  - master schedules
  - control by exception
  - computer control
  - visual control
  - combination MRP2/Kanban system
  - shop floor - day-to-day - Kanban
- scheduling:
  - techniques
  - order release
  - policies
  - centralised
  - decentralised
- inventory control:
  - raw
  - work-in-process
  - finished goods
  - lean manufacture and inventory
  - inventory costs
  - procurement
  - material control techniques
  - ABC (Pareto) Analysis
  - Economic Order Quantity (EOQ)
  - Min-Max systems
  - Kanban - Just in Time
  - cycle counting

**Evidence Guide****EVIDENCE GUIDE**

## EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to use ERP, MRP planning software systems in manufacturing. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using ERP, MRP planning software systems in manufacturing, or other units requiring the exercise of the skills and knowledge covered by this unit.

### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate will have access to all tools, equipment, materials and documentation required. The candidate will be permitted to refer to any relevant workplace procedures, product

**EVIDENCE GUIDE**

	and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>System</b>	Includes ERP, MRP or similar software programs
<b>Appropriate actions</b>	Appropriate actions are actions in regard to production schedules, materials management, purchasing and ordering, transport and logistics that are needed as a result of information obtained from resource planning software
<b>Resource planning information</b>	May include information from ERP, MRP or similar systems that provide information on master production schedule, materials requirement plan, capacity requirement plan, bills of material, inventory control and statistics, order action, schedules

**Unit Sector(s)**

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30020A Develop and manage a plan for a simple manufacturing related project

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers developing and managing low risk manufacturing related projects that may be small scale and managed by one person and are carried out under guidance.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to technical work in all environments.</p> <p>Work is carried out under supervision.</p> <p>If skills in development of production schedule are required, then Unit MEM30021A (Prepare a simple production schedule) should be selected.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		



## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Select appropriate project management tools and develop project plan	<p>1.1.A working knowledge of project management tools is used to develop a plan for a simple manufacturing related project and schedule of activities to meet project outcomes.</p> <p>1.2.The plan is referred to a supervisor for approval in accordance with policy and procedures.</p>
2. Implement planned activities	<p>2.1.Plan is implemented according to schedule.</p> <p>2.2.All affected personnel are communicated with regarding project implementation.</p> <p>2.3.Supply and/or allocation of required resources including materials and equipment is organised.</p> <p>2.4.Project progress is regularly reported in relation to agreed milestones to provide a measure of performance throughout the life of the plan.</p> <p>2.5.Progress is discussed in consultation with other staff and contractors to ensure effective outcomes.</p>
3. Review project plan and schedule	<p>3.1.Project outcomes, performance standards and project objectives are monitored and analysed against specifications and the results are reported in</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>accordance with procedures.</p> <p>3.2. Variations in keeping to plan are discussed with supervisors and are resolved in accordance with enterprise policy and procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using computing skills
- using interpersonal communication skills
- negotiating
- report writing
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- understanding of applicable regulations and standards
- appropriate software
- Gantt charts
- critical path method (CPM)
- bar charts
- work breakdown structures
- program evaluation and review technique (PERT)
- basic quality assurance techniques
- knowledge of availability of resources
- safe work practices and procedures
- a basic knowledge of:
  - the project life cycle and the relationship between project phases

**REQUIRED SKILLS AND KNOWLEDGE**

- planning and control procedures, resource management and risk management

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to develop and manage a plan for a simple manufacturing related project.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with developing and manage a plan for a simple manufacturing related project or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond

<b>EVIDENCE GUIDE</b>	
	those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Project management tools</b>	May include critical path method (CPM), bar and Gantt charts, work breakdown structures, Program Evaluation and Review Technique (PERT), project management software packages, recording systems - electronic and manual
<b>Plan</b>	May include project implementation plans, quality assurance targets, milestones, any planning that relates to time, cost or quality and requires that progress is communicated to others
<b>Simple manufacturing related project</b>	Projects that are small scale, low risk, managed by one person, carried out under guidance, related to manufacturing processes and products

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Engineering technician
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## MEM30021A Prepare a simple production schedule

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers preparing a simple production schedule in manufacturing. For skills associated with determining steps in manufacturing process see Unit MEM30018A (Undertake basic process planning).
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all manufacturing and engineering workplace environments. It covers the scheduling of production that involves several interconnected manufacturing processes.</p> <p>All work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify production requirements	1.1.The production processes to be used are identified from instructions and specifications provided. 1.2.Customer requirements in terms of volume, delivery time and arrangements and quality are obtained from supervisor or other appropriate sources. 1.3.Customer and process requirements are analysed to determine production requirements.
2. Develop an activity plan production requirements	2.1.Production requirements are divided into activity elements. 2.2.A network diagram is constructed. 2.3.The critical path is determined. 2.4.The latest start/earliest finish and slack time are determined for activity elements to meet requirements. 2.5.Assistance and approval from supervisor is obtained.
3. Prepare the production schedule	3.1.A production schedule is prepared which lists: 3.1.1. customer requirements 3.1.2. time constraints 3.1.3. production requirements

ELEMENT	PERFORMANCE CRITERIA
	<ul style="list-style-type: none"><li>3.1.4. machine availability and capability</li><li>3.1.5. inventory requirements</li><li>3.1.6. procurements</li><li>3.1.7. supply capacities</li><li>3.1.8. contingency analysis.</li><li>3.2.A simple bill of materials required is prepared to assist in control of materials.</li><li>3.3.Schedule is depicted using a Gantt chart or similar graphical display.</li><li>3.4.Schedule allows for future changes to improve performance.</li><li>3.5.Assistance and approval from supervisor is obtained.</li></ul>
4. File and issue the schedule	<ul style="list-style-type: none"><li>4.1.The schedule is reviewed and tested with appropriate personnel.</li><li>4.2.The schedule is referred to appropriate personnel for implementation.</li><li>4.3.All supporting documents are provided for implementation.</li><li>4.4.The schedule is filed/issued according to workplace procedures.</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- prioritising
- communicating
- managing time
- organising
- documenting
- using project management tools
- analysing
- calculating



## REQUIRED SKILLS AND KNOWLEDGE

- reading, interpreting and following information on written job instructions, specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- planning and sequencing operations
- checking and clarifying task-related information

### Required knowledge

Look for evidence that confirms knowledge of:

- basic knowledge of:
  - types of production
  - jobbing production
  - batch production
  - process production
  - Just in Time procedures
  - cellular manufacture
  - scheduling
  - interpreting customer requirements
  - machine capability and selection
  - Gant charts
  - contingency plans
  - introduction to project planning techniques
  - introduction to PERT/CPM diagrams
  - introduction to critical path networks
- hazards and control measures associated with preparing a simple production schedule, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to prepare a simple production schedule.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and to be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing a simple production schedule, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Simple production schedule**

- Applies to the preparation of a schedule for the manufacture of a single component or single assembly function; or to operations for a single small production work unit or production cell
- The schedule will involve only a small number of constraints or variables

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

Co-requisite units		

**Competency field**

<b>Competency field</b>	Engineering technician
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## MEM30022A Undertake supervised procurement activities

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers planning and executing standard procurement activities to achieve required outcomes under the direction and guidance of an experienced procurement officer.
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### Application of the Unit

<b>Application of the unit</b>	Work is carried out under supervision.  <b>Band: 0</b> <b>Unit Weight: 0</b>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>	
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### Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan procurement activities	<p>1.1.The procurement requirements and outcomes are interpreted, understood and, where necessary, clarified.</p> <p>1.2.Instructions for procedures to manage standard contract in accordance with legislation, policy and procedures are obtained.</p> <p>1.3.Supplier is selected in accordance with workplace procedures.</p>
2. Establish contractual arrangements	<p>2.1.Method of requesting and receiving offers is in accordance with organisational policy and procedures.</p> <p>2.2.Evaluation and selection of offer is made in consultation and in accordance with policy and procedures.</p> <p>2.3.Contractual arrangements are submitted for approval and formalised in accordance with policy and procedures.</p> <p>2.4.Notification of successful and unsuccessful suppliers occurs in accordance with organisational policy and procedures.</p>
3. Follow up on contracts	<p>3.1.Start-up or transition arrangements are confirmed and monitored in accordance with policy and procedures.</p> <p>3.2.Communication strategies are implemented to ensure effective relationship with contractor/s is managed in accordance with policy and procedures.</p> <p>3.3.Contractual obligations to contractors are met in accordance with policy and procedures.</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>3.4. Contractor performance is monitored to ensure contractual obligations are being met.</p> <p>3.5. Approvals are obtained for any contract variations in accordance with organisational and contractual requirements.</p> <p>3.6. Disputes/complaints procedures are followed and implemented in accordance with contractual requirements.</p> <p>3.7. Records are maintained in accordance with organisational and legal requirements to provide an audit trail and for other organisational purposes.</p>
4. Complete contractual arrangements	<p>4.1. Goods or services received are verified as meeting outcomes required.</p> <p>4.2. Contracts are finalised, cancelled or terminated in accordance with organisational and contractual requirements.</p> <p>4.3. Records are maintained in accordance with organisational requirements.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- planning and evaluating
- using numeracy skills for developing and using a budget and contractual timeframes
- effectively consulting and negotiating with suppliers involving oral and written exchanges
- using writing skills for procurement specification in unambiguous terms
- reading contractual agreements which may include complexity of language and style
- undertaking ongoing communication with contractor which may involve explanation or clarification of written and oral information; note-taking at meetings; active listening; checking for understanding and recording
- using numeracy skills for scheduling activities, and planning activities and

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
timeframes
<b>Required knowledge</b>
<p>Look for evidence that confirms knowledge of:</p> <ul style="list-style-type: none"> <li>• applicable Commonwealth/State/Territory government legislation</li> <li>• procurement policies and practices</li> <li>• method of requesting and receiving offers</li> <li>• procurement approval procedures</li> <li>• evaluation and selection of offer</li> <li>• procedures to manage the contract in accordance with legislation, policy and procedures</li> <li>• procedures for receipt and payment of goods or services</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to undertake supervised procurement activities.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other</p>

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with undertaking supervised procurement activities, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Standard contract</b>	Covers contracts where deliverables and conditions desired from the supplier have already been determined by the company and where there are pre-existing procedures for requesting and receiving offers
<b>Method of requesting and receiving offers</b>	May include request for quotation, request for offer, direct purchases using existing supply agreements such as standing offers, common use arrangements, oral quotations, written quotations,



<b>RANGE STATEMENT</b>	
	direct purchase from retail or wholesale outlets, electronic commerce
<b>Evaluation</b>	May include price comparison, timing, suitability
<b>Contractual arrangements</b>	May include verbal and written orders, purchase order, credit card, petty cash, memoranda of understanding/ memoranda of agreement, in-house service level agreements, contracts, common use arrangements/ standing offers
<b>Records</b>	May include purchase requests and orders, invoices and payment requests, statements and petty cash vouchers, offer and contract documents, evaluation process documentation, records of authorised officers' decisions, records of supplier performance

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30023A Prepare a simple cost estimate for a manufactured product

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers applying basic principles and concepts associated with the preparation of a cost estimate for a product.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all manufacturing and engineering workplace environments. Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain tender/cost estimate requirements	1.1.Tender/cost estimate brief is obtained within established organisational framework, procedures and routines. 1.2.Key requirements are identified. 1.3.Assistance/approval from supervisor is obtained.
2. Prepare a simple cost estimate	2.1.Relevant costing data is identified and interpreted from the tender/cost estimate documents. 2.2.Organisational production costs are obtained. 2.3.Cost estimates are prepared according to established organisational framework, procedures and routines. 2.4.Assistance/approval from supervisor is obtained.
3. Verify cost estimate	3.1.Actual cost information is sourced from a completed tender/cost estimate project. 3.2.Actual costs are compared with estimated cost to identify deviations. 3.3.A report is prepared for supervisors to explain deviations according to established organisational framework, procedures and routines. 3.4.Assistance/approval from supervisor is obtained.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures and other applicable reference documents
- undertaking simple report writing
- planning and sequencing operations
- checking and clarifying task-related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- overview of the impact on cost estimates of:
  - product manufacture
  - demand vs. capability
  - make-or-buy
  - market-demand-price-competition
  - cost control
  - product costs
  - materials
  - resource consumption (water, power, etc.)
  - labour
  - standard time/usage
  - margins, profit/loss
  - using proforma estimate sheets
  - using estimates as targets
  - impact of value adding non value adding activities
- lead times associated with:
  - raw material availability
  - equipment, tool design and commissioning
  - prototypes and trial builds
  - estimating processes
  - use of contract documents - drawings, specifications
  - consideration of general conditions and any special conditions

**REQUIRED SKILLS AND KNOWLEDGE**

- application of resources costs - hourly rates (labour, plant, material, subcontractors)
- contingency costs
- allowance for contract variations
- hazards and control measures associated with preparing a simple cost estimate for a manufactured product, including allowing for housekeeping, safe work practices and procedures

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to prepare a simple cost estimate for a manufactured product.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing a simple cost estimate for a manufactured product, or other units requiring the exercise of the skills and knowledge covered by this unit.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Simple cost estimate</b>	<ul style="list-style-type: none"> <li>Based on known production and material costs</li> <li>Cost can be estimated using a limited number of variables</li> <li>Estimate relates to a discrete product with a limited number of operations for manufacture</li> </ul>
<b>Tender/cost estimate brief</b>	May include project guidelines and instructions, internal or external requirements, information from tender/contract documents, drawing specifications
<b>Key requirements</b>	May include timing, budget, resources, output, special conditions
<b>Deviations</b>	Reported as fractions or percentages, does not

**RANGE STATEMENT**

	include standard deviations, six sigma etc.
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**Unit Sector(s)**

Unit sector	
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**Co-requisite units**

Co-requisite units		

**Competency field**

Competency field	Engineering technician
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## MEM30024A Participate in quality assurance techniques

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers participating in quality improvement programs at a basic level.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all fields of engineering. Skills are applied to working in teams and work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM15001B	Perform basic statistical quality control

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret and apply quality standards and procedures	1.1. Quality standards and procedures are interpreted and applied to individual and teamwork in accordance with standard operating procedures.
2. Monitor and report on quality	2.1. Quality of all received, in-work and finished materials and products is monitored as required in accordance with standard operating procedures. 2.2. Designated process improvement tools are used either individually or in a team to identify and solve design, development and production quality problems. 2.3. Designated analytical tools are used to evaluate principal causes of process variation in consultation with the team or other subject experts. 2.4. Further action to improve quality is recommended, where required, using standard operating procedures.
3. Assist in implementing approved improvement strategy or strategies	3.1. Key indicators and performance measures are established and agreed in consultation with the team or other subject experts. 3.2. Process, product output is measured against key indicators in consultation with the team or other subject experts. 3.3. Steps are taken to lock in improvements in accordance with standard operating procedures.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking problem solving
- undertaking basic arithmetic calculations
- interpreting known data
- using standard texts and references
- undertaking simple report writing
- reading and interpreting engineering specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- the importance of quality
- the key principles of quality improvement programs
- the influence of variation
- use and application of Australian standards/ ISO 9000 etc.
- quality policy
- quality manuals
- quality procedures
- quality definitions
- purpose of quality audits
- simple sampling techniques and possible sources of sampling error and bias
- simple statistical tools
- problem solving techniques including:
  - process flow charts, interpretation and construction of simple case
  - cause and effect diagrams, fault trees etc.
  - root cause analysis
  - Pareto diagrams

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to participate in quality assurance techniques - basic. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with participating in quality assurance techniques - basic, or other units requiring the exercise of the skills and knowledge covered by this unit.

#### Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**EVIDENCE GUIDE**

<b>Guidance information for assessment</b>	
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Quality standards and procedures</b>	Includes quality programs such as TQC, six sigma etc., quality policy, quality manuals, ISO 9000 and associated quality standards
<b>Process improvement tools</b>	Includes process flow charts, cause and effect diagrams, brainstorming sessions, Pareto diagrams, check sheets, run chart, scatter diagrams etc.
<b>Analytical tools</b>	Can include statistical analysis, critical incident analysis, root cause analysis etc.

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>	

<b>Co-requisite units</b>		

## Competency field

<b>Competency field</b>	Engineering technician
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## MEM30025A Analyse a simple electrical system circuit

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers analysing a simple circuit by identifying the function and operation of the circuit and circuit components contained within approved manufactured products.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all manufacturing environments. It covers analysis of existing circuits against specifications only and does not extend to determining modifications to circuits.</p> <p>This unit does not cover the skills involved in direct measuring of values requiring connecting or disconnecting of circuits and components covered by licensing requirements. Where such values are required they are to be obtained through the assistance of appropriately licensed personnel or through undertaking the specified training for the appropriate licence.</p> <p>Work is conducted in accordance with regulatory and legislative requirements in each State and Territory</p> <p>Work is carried out under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Refer to Application of the Unit

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Establish function and purpose of selected circuit	<p>1.1.All relevant drawings, specifications, manuals and documentation are obtained and interpreted in accordance with workplace procedures.</p> <p>1.2.Circuit and component installation is observed where required to establish function and purpose.</p> <p>1.3.Safety procedures to be followed are determined in conjunction with supervisors and in accordance with legislative and regulatory requirements.</p> <p>1.4.Appropriate personnel are consulted with to establish job requirements.</p>
2. Extract a circuit diagram from	2.1.Appropriate components and assemblies are identified.



ELEMENT	PERFORMANCE CRITERIA
existing drawings and documentation	2.2. Where required, components and/or materials are identified from supplier/manufacturer catalogues. 2.3. Circuit diagram is extracted. 2.4. Drawing conventions and symbols are used in the diagram in accordance with codes and workplace procedures.
3. Analyse the circuit for electrical characteristics	3.1. Functions of the circuit and components are compared against design characteristics and operational specifications.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- calculating
- reading and interpreting specifications and drawings
- drawing to scale
- analysing
- planning and sequencing operations
- checking and clarifying task-related information
- checking for conformance to specifications

#### Required knowledge

Look for evidence that confirms knowledge of:

- safe work practices and procedures
- hazard and control measures associated with analysing the function of a simple electrical system circuit
- dangers and safety precautions:
  - electrical hazards
  - earthing and insulation
- The function of the following components:
  - resistors:
    - fixed (composition and wire wound)

**REQUIRED SKILLS AND KNOWLEDGE**

- variable (rheostats, potentiometers and trimmers)
- non-linear (thermistors)
- capacitors:
  - fixed (ceramic, plastic and electrolytic)
  - variable
  - magnetic
  - transformers (AF, RF and power)
  - chokes
  - relays
  - contactors
  - rectifiers
  - smoothing filters
  - voltage regulators and feedback
- basic physics:
  - conductors
  - insulators
  - semiconductors
  - current flow
  - voltage
  - resistance
  - colour code
  - power rating
  - Ohm's Law
  - electrical units
  - power in electrical circuits
- protection methods:
  - fuses
  - circuit breaking
  - safety interlocks
  - earthing - personnel safety
- a.c. circuits:
  - series and parallel a.c. circuits
  - power in a.c. circuits
- power supplies:
  - transformers
  - rectifiers
  - smoothing filters
  - voltage regulators and feedback

**REQUIRED SKILLS AND KNOWLEDGE**

- function and operation of a simple low voltage d.c. power supply
- function and operation of the transformer in a simple low voltage d.c. power supply, including the significance of the turns ratio
- function in a simple low voltage d.c. power supply of rectifiers including the significance of the diode characteristics, for both half and full wave types
- operation of smoothing filters in a simple low voltage d.c. power supply
- operation of simple zener diode type voltage regulators in a simple low voltage d.c. power supply
- feedback

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to analyse the functions and components of a simple electrical system circuit. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication,

**EVIDENCE GUIDE**

	materials handling, recording and reporting associated with analysing a simple electrical system circuit or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Components and assemblies**

Can include:

- resistors - fixed (composition and wire wound), variable (rheostats, potentiometers and trimmers), non-linear (thermistors)
- capacitors - fixed (ceramic, plastic and electrolytic), variable, magnetic, transformers (AF, RF and power), chokes, relays, contactors, rectifiers, smoothing filters, voltage regulators and feedback

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Engineering technician
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## MEM30026A Select and test components for simple electronic switching and timing circuits

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers selecting common electronic components to suit basic applications, and performing basic electronic calculations.
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### Application of the Unit

<b>Application of the unit</b>	All work carried out under supervision.  <b>Band: 0</b> <b>Unit Weight: 0</b>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM12024A	Perform computations

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Perform basic electronic calculations	<p>1.1. Calculations are performed for a given circuit voltage, current, resistance and d.c. power.</p> <p>1.2. The period, frequency, RMS, peak and peak-to-peak voltages are calculated for a given repetitive waveform.</p> <p>1.3. Waveform calculations are verified using an oscilloscope.</p>
2. Select, test and use simple electronic switching circuits	<p>2.1. Transistors required for simple switching applications are selected.</p> <p>2.2. The circuit is wired up and tested using suitable prototyping equipment.</p> <p>2.3. Calculations are verified.</p>
3. Select, test and use simple electronic timing circuits	<p>3.1. The appropriate timing circuit is selected and the time constant is calculated.</p> <p>3.2. The circuit is wired up and tested using suitable prototyping equipment.</p> <p>3.3. Calculations are verified.</p>
4. Select common power supplies and power control devices	<p>4.1. Appropriate rectification is selected.</p> <p>4.2. Appropriate power control devices are selected.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- using a multimeter to measure a.c. and d.c. voltages, resistance and capacitance
- setting an oscillator/signal generator to a specified frequency and amplitude
- using an oscilloscope to record wave shapes and to measure the peak-to-peak voltage and the period of any repetitive waveform
- identifying sine waves, cosine waves, square waves, triangular waves and sawtooth waves
- communicating
- planning
- assessing
- problem solving
- reading, interpreting and following information on written job instructions, specifications, standard operating procedures and other applicable reference documents
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit
- checking for conformance to specifications
- checking and clarifying task related information

#### Required knowledge

Look for evidence that confirms knowledge of:

- electronic concepts and units
- voltage
- current
- resistance and capacitance
- power
- frequency and period
- common electronic instruments
- multimeters
- power supplies
- signal generators
- oscilloscopes



## REQUIRED SKILLS AND KNOWLEDGE

- timing circuits and oscillators
- semiconductor devices
- diodes (power, zener, LEDs)
- transistors
- linear integrated circuits
- power control devices (triacs, SCRs)
- power supplies
- hazards and control measure associated with selecting and test components for simple electronic switching and timing circuits, including housekeeping
- safe work practices and procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to select and test components for simple electronic switching and timing circuits. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing components for simple electronic switching and timing circuits, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Simple electronic switching circuit</b>	Includes simple transistor switches and simple linear integrated circuits
<b>Suitable prototyping equipment</b>	Includes breadboards
<b>Appropriate timing circuit</b>	Includes simple RC timing circuit, type 555 integrated circuit, etc.
<b>Appropriate rectification</b>	May include half or full wave

## RANGE STATEMENT

### Power control devices

May include zener diodes and LEDs. SCRs and triacs

## Unit Sector(s)

### Unit sector

## Co-requisite units

### Co-requisite units

## Competency field

### Competency field

Engineering technician

## MEM30027A Prepare basic programs for programmable logic controllers

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers writing, testing, editing and monitoring programs using a hand program loader.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all fields of engineering and manufacturing. Work is done under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Write and test basic programs using a hand program loader	1.1. Programs are written in accordance with programming rules. 1.2. Programs are loaded into a PLC. 1.3. Programs are verified with a supervisor. 1.4. The operation of programs is tested with assistance from a supervisor.
2. Edit and monitor basic programs using a hand program loader	2.1. The monitoring function is used to verify circuit conditions and check the current values of timers and counters. 2.2. Editing features are used to make minor program changes.

## Required Skills and Knowledge

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
This section describes the skills and knowledge required for this unit.
<b>Required skills</b>

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms skills in:

- communicating
- planning
- assessing
- problem solving
- analysing
- reading and interpreting engineering specifications, standard operating procedures and other applicable reference documents
- organising information
- using numeral operations, geometry and calculations/formulae within the scope of this unit
- checking for conformance to specifications
- planning and sequencing operations
- checking and clarifying task-related information

**Required knowledge**

Look for evidence that confirms knowledge of:

- hazards and control measures associated with preparing basic programs for PLC, including housekeeping
- safe work practices and procedures
- General knowledge of programmable controllers including:
  - basic PLC operation: definitions, terminology and block diagrams; scan cycle
  - basic programming rules; addressing for I/O; halt; run
  - programming (using a hand programmer): flowcharts/steps to use when programming; clearing of memory; ladder format
- Boolean/mnemonic/statement list format; series circuits; parallel circuits; latching circuits; stack register operation; combination series/parallel circuits; inversion elements; timers
- counters; monitoring of discrete I/O and timer/counter values; edit (insert and delete elements)
- connection of discrete input and output devices to a PLC

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare basic programs for programmable logic controllers.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with preparing basic programs for programmable logic controllers, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Programs**

Includes series elements, parallel elements, combination series parallel elements, basic timers and counters

## Unit Sector(s)

**Unit sector**

## Co-requisite units

**Co-requisite units**


## Competency field

**Competency field**

Engineering technician



## MEM30028A Assist in sales of technical products/systems

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers assisting to identify opportunities for the sale of technical products/systems and providing technical product information to internal and external clients.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to all fields of engineering and manufacturing. Work is done under supervision.</p> <p><b>Band: 0</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Develop product knowledge in a nominated area	1.1.Product purpose/s and use/s are identified 1.2.Key features of the product are identified. 1.3.Product features are identified. 1.4.The strengths and weaknesses of competitors' products are established from available sources.
2. Assist in identification of sales prospects	2.1.Assist in identification of potential clients from available sources in accordance with company procedures 2.2.Assist in targeting present, previous and new clients through nominated prospecting methods as required.
3. Apply product knowledge to client requirements	3.1.Assist in the development and presentation of product/system promotional information. 3.2.Provide information on the technical product/process to meet the client's requirements.
4. Assist in closing the sale	4.1.Conditions of the agreement are negotiated. 4.2.Process and completion of the sales transaction comply with organisational requirements.
5. Assist in providing after sales service	5.1.Assist in matching client's need and identifying opportunities for improvement/s. 5.2.Assist in training clients in applying technical products.

ELEMENT	PERFORMANCE CRITERIA
	5.3.Review and report on client's feedback.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- communicating
- literacy skills to interpret legal requirements, product labelling and description and organisational requirements
- sales data interpretation skills
- information management skills, including the ability to summarise information verbally and non-verbally
- ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities
- use of internet and other technology to locate prospect information
- interpretation of numerical data associated with prospects
- use of technology to store and manage prospect information
- ability to apply analytical skills in relating products to prospects' requirements
- negotiation skills

#### Required knowledge

Look for evidence that confirms knowledge of:

- basic product knowledge in a specific nominated area
- buying and selling processes
- organisational requirements, including policy and procedures
- key competitors and their products
- industry trends and developments
- legislative and regulatory requirements relevant to the product/s in regard to occupational health and safety and environmental issues
- range of prospecting methods, and prospect information management strategies
- prospecting as a key component of the overall sales process
- familiarity with range of buyer motives
- sales closure techniques, and situations in which it is appropriate to attempt closure
- safe work practices and procedures

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to assist in sales of technical products/systems.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with assisting in sales of technical products/systems, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

<b>EVIDENCE GUIDE</b>	
	standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Nominated area</b>	A range of products within a particular industry which has been nominated by the employer and employee
<b>Features</b>	The capability elements, including strengths and weaknesses of the product to deliver benefits to potential buyers
<b>Available sources</b>	Other company personnel, catalogues, trade association magazines, trade shows, competitors' sales literature, competitor websites, internal sales and data records
<b>Prospecting methods</b>	<ul style="list-style-type: none"> <li>• Prospecting is defined here as A continuous process of gathering the names of potential buyers who are likely to be interested in purchasing the salesperson's product</li> <li>• Prospecting methods may include referrals, networking, personal observation, intra-organisational leads, spotters, cold canvassing, direct mail, media advertising, telemarketing, journals, magazines, newspapers</li> </ul>
<b>Conditions</b>	Price, delivery, payment options, client loyalty and length of contract. warranty

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Engineering technician
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## **MEM30029A Use workshop equipment and processes to complete an engineering project**

### **Modification History**

Release 1 (MEM05v9)

### **Unit Descriptor**

This unit of competency covers the identification and use of a range of common workshop equipment and processes to complete a simple engineering project.

It also focuses on developing and applying basic workshop skills and developing knowledge about equipment and processes and relating it to typical technical work requirements.

### **Application of the Unit**

This unit applies to technical employees undertaking projects or operations requiring processes, techniques and workshop practices to produce items or components. The unit is broad-based and aims to assist technical workers to better integrate their roles into a manufacturing or engineering environment through exposure to basic, practical engineering workshop equipment and processes.

The unit is intended for technical workers, where practical workshop skills do not form a major part of the work role.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

## Elements and Performance Criteria

1	Research common engineering workshop equipment and processes	1.1	Identify sources of professional, technical and trade assistance
		1.2	Identify common processes and techniques for working, shaping and joining metal, alloys and others materials
		1.3	Identify common engineering hand and power tools and their applications
		1.4	Identify common workshop equipment and applications
2	Identify resources required to manufacture a simple engineered item	2.1	Interpret design information from drawings and instructions
		2.2	Select processes and techniques appropriate to task and level of skill
		2.3	Identify required tools, equipment, material and services
		2.4	Prepare a simple work plan showing operational sequences, work priorities and optimal use of time and resources
3	Use workshop equipment and processes to manufacture a simple engineered item	3.1	Correctly prepare materials and equipment for the required operations
		3.2	Use tools and machines safely and correctly
		3.3	Follow work health and safety (WHS) procedures, standard operating procedures and supervisor instructions are correctly
		3.4	Obtain assistance from appropriate persons in the event of problems and difficulties
		3.5	Follow safe work practices and procedures
		3.6	Implement hazard control measures, where practicable
		3.7	Complete item manufacturing and check against



			specifications and work plan
		3.8	Clear work area of scrap and waste
		3.9	Clean work and secure equipment and work area according to standard procedures
4	Assess workshop equipment and processes to technical engineering activities and engineering design process	4.1	Justify selected workshop processes in terms of design criteria
		4.2	Assess selected tools and equipment for process safety and efficiency
		4.3	Evaluate task and workshop processes against typical technician work activities

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading, confirming and following information on written job instructions, manufacturer specifications, standard operating procedures, charts, lists, drawings and other applicable reference documents
- identifying hazards and applying safe work practices and risk control measures
- communicating with appropriate persons
- following oral instruction and standard procedures
- applying numeracy, calculations and measurements within the scope of this unit
- accurately transferring dimensions to work pieces
- planning and sequencing tasks
- safely operating machines, hand tools and power tools
- setting up machines and tooling for basic operations

### Required knowledge

Required knowledge includes:

- task planning and sequencing of operations
- marking out tools, techniques and media
- common measurement tools and techniques
- allowances and tolerances

- common engineering materials
- common hand tools and their applications
- common fixed and portable power tools and their applications
- common engineering machine operation
- common workshop techniques, such as hand and machine cutting, drilling, tapping, grinding, machining, welding, bending and shaping, and assembly
- workshop and machine safety, hazard identification and hazard control
- work holding methods
- basic tooling identification
- speeds and feeds
- machine set-up and operation
- cutting fluids and basic operational maintenance of machines
- assembly and fixing techniques, tools and accessories

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to plan and safely and efficiently undertake the manufacture a simple item using a range of hand and power tools and workshop machinery.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• prepare a basic work plan</li> <li>• identify and prepare selected materials and equipment</li> <li>• apply manual workshop techniques using a range of hand and power tools</li> <li>• use common engineering workshop equipment and machinery to complete individual parts of a project</li> <li>• assemble the component parts of a given project using a range of joining techniques</li> <li>• complete work requirements to specification</li> <li>• follow WHS procedures and hazard control strategies at all times.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, then a simulated working environment must be used where the range</li> </ul>

	<p>of conditions reflects realistic workplace situations.</p> <ul style="list-style-type: none"> <li>• The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Appropriate persons</b>	<p>Appropriate persons will vary according to the nature of assistance and advice required and may include:</p> <ul style="list-style-type: none"> <li>• supervisor</li> <li>• leading hand</li> <li>• foreman</li> <li>• trainer/coach</li> <li>• technicians</li> <li>• tradespersons</li> <li>• engineers</li> </ul>
<b>Engineering processes and techniques</b>	<p>Engineering processes and techniques include:</p> <ul style="list-style-type: none"> <li>• hand and machine cutting</li> <li>• drilling</li> <li>• tapping</li> <li>• grinding</li> <li>• machining</li> <li>• welding</li> <li>• bending and shaping</li> <li>• assembly using a variety of fasteners and hand tools</li> </ul>
<b>Hand and power tools</b>	<p>Hand and power tools may include:</p> <ul style="list-style-type: none"> <li>• screwdriver</li> <li>• spanners</li> <li>• hammers</li> <li>• files</li> <li>• jigs</li> <li>• cutting tools</li> <li>• scribes</li> <li>• chisels</li> <li>• centre punches</li> <li>• measurement instruments</li> <li>• gauges</li> <li>• portable drills</li> <li>• pedestal or bench grinder</li> </ul>
<b>Workshop cutting and machining equipment</b>	<p>Workshop machining and cutting equipment may include:</p> <ul style="list-style-type: none"> <li>• cut-off machines</li> <li>• surface grinders</li> <li>• drills</li> <li>• lathes</li> <li>• mills</li> <li>• planers</li> </ul>

	<ul style="list-style-type: none"> <li>• fuel gas cutting torch</li> </ul>
<b>Fabrication equipment</b>	<p>Fabrication equipment may include:</p> <ul style="list-style-type: none"> <li>• nibblers</li> <li>• metal shears</li> <li>• guillotines</li> <li>• pedestal drills</li> <li>• power saws</li> <li>• rivet fastening equipment</li> <li>• pan brake</li> <li>• press brake</li> <li>• universal metal working machine</li> </ul>
<b>Welding equipment</b>	<p>Welding equipment includes:</p> <ul style="list-style-type: none"> <li>• hoses, welding leads, gas shrouds, gas regulators, liners and contact tips – gas metal arc welding (GMAW)</li> <li>• welding leads, welding machines and electrode holder – manual metal arc welding (MMAW)</li> <li>• fuel gas and handheld thermal cutting equipment (thermal cutting)</li> </ul>
<b>Preparation of materials and equipment</b>	<p>Preparation of materials and equipment may include:</p> <ul style="list-style-type: none"> <li>• marking out</li> <li>• preheating</li> <li>• cleaning</li> <li>• setting up jigs and fixtures</li> <li>• clamping</li> <li>• tooling preparation, including basic sharpening</li> <li>• machine settings</li> </ul>
<b>Safe work practices and procedures</b>	<p>Safe work practices and procedures include:</p> <ul style="list-style-type: none"> <li>• relevant legislation</li> <li>• personal protective equipment</li> <li>• material safety management systems, including use of material safety data sheets (MSDS)</li> <li>• hazardous substances and dangerous goods code</li> <li>• local safe operating procedures</li> <li>• correct disposal of: <ul style="list-style-type: none"> <li>• liquid waste</li> <li>• solid waste</li> </ul> </li> <li>• minimisation, suppression and venting of gas, fume, vapour, smoke emissions, including fugitive emissions, as appropriate</li> </ul>

	<ul style="list-style-type: none"> <li>• avoiding excessive energy and water use</li> <li>• avoiding excessive noise</li> <li>• awareness of safe proximity limits and shielding procedures to other personnel</li> <li>• working safely around machinery</li> <li>• working safely with tools and equipment</li> <li>• risk and hazard recognition</li> <li>• emergency procedures</li> <li>• awareness of electrical hazards</li> <li>• first aid sources and procedures for the workplace</li> </ul>
<b>Standard operating procedures</b>	<p>Standard operating procedures may include:</p> <ul style="list-style-type: none"> <li>• the use of tools and equipment</li> <li>• instructions, including job sheets, cutting lists, plans, drawings and designs</li> <li>• reporting and communication</li> <li>• manufacturer specifications and operational procedures</li> <li>• emergency procedures</li> </ul>
<b>Elements of the engineering project</b>	<p>Elements of the engineering job may include:</p> <ul style="list-style-type: none"> <li>• tool and equipment selection</li> <li>• sequencing of operations</li> <li>• techniques and processes</li> <li>• conformance to specifications</li> <li>• material types</li> <li>• quantities produced</li> </ul>
<b>Technical work activities</b>	<p>Technical work activities may include:</p> <ul style="list-style-type: none"> <li>• design</li> <li>• production</li> <li>• quality assurance</li> <li>• product testing</li> <li>• purchasing</li> <li>• commissioning</li> <li>• scheduling</li> <li>• planning</li> <li>• drafting</li> </ul>

## Unit Sector(s)

### Competency field

**Unit sector**            Engineering technician

## Custom Content Section

Not applicable.

## **MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply functions of computer-aided design (CAD) software programs that are typically used in the production of detail drawings.

### **Application of the Unit**

This unit is suitable for those working within a CAD or drafting work environment and may be applied across engineering and manufacturing environments. It covers competent use of a CAD program to perform basic drawing tasks used in the development of detail drawings. Drawings may include plans, diagrams, charts, circuits, systems or schematics.

This unit includes using computer equipment and selecting software functions in order to generate basic drawing elements.

Work is conducted under supervision.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of



performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                                       |     |   |
|---|---------------------------------------|-----|---|
| 1 | Confirm drawing requirements          | 1.1 | Confirm purpose, scope, and information and presentation requirements for drawing   |
|   |                                       | 1.2 | Review available information relevant to project and work requirements, and identify and address further information needs          |
|   |                                       | 1.3 | Identify computing equipment and software used in the organisation  |
|   |                                       | 1.4 | Identify work flow and procedures for work supervision  |
|   |                                       | 1.5 | Examine requirements for presentation of drawings   |
| 2 | Identify key features of CAD software | 2.1 | Describe types of CAD software used for detail drafting, their key features and suitability for producing specific drawing outcomes |
|   |                                       | 2.2 | Describe types of CAD software used for design drafting, their key features and suitability for producing specific drawing outcomes |
|   |                                       | 2.3 | Identify differences in CAD process to generate 2-D drawings and 3-D models, and reasons for each presentation                      |
|   |                                       | 2.4 | Identify differences in CAD process to generate single and multiple view drawings, and reasons for each presentation                |
|   |                                       | 2.5 | Identify CAD software used in the organisation and confirm compatibility with other software programs and peripheral equipment      |
|   |                                       | 2.6 | Identify software features for linked specifications, catalogues or materials ordering  |
| 3 | Access software and set up for        | 3.1 | Open software and navigate organisational filing and library system   |

drawing work	3.2	Identify organisational and software templates and determine uses
	3.3	Identify organisational symbols, codes and standards to be applied in drafting work and how these are accessed and applied
	3.4	Apply workplace procedures to retrieve and manipulate required information and navigate computing technology
	3.5	Set up working environment
4 Produce basic drawing elements	4.1	Use CAD functions to produce basic drawing elements
	4.2	Use editing and transfer tools and methods to modify drawing elements
	4.3	Apply dimensions, text and symbols to drawing elements
	4.4	Import and export files into/out of working space
	4.5	Generate different views and perspectives
	4.6	Organise presentation of work
5 Complete CAD operations	5.1	Save and file drawing elements according to organisational procedures
	5.2	Print drawing elements and evaluate presentation
	5.3	Evaluate work and identify areas for improvement
	5.4	Close applications, perform CAD housekeeping and maintain organisational filing system

## Required Skills and Knowledge

### Required skills

Required skills include:

- literacy skills sufficient to read instructions for drawings work

- using computer technologies and navigating software
- numeracy skills sufficient to interpret technical information and determine scaling and layout issues
- navigating software to:
  - manipulate drawing entities
  - modify dimension styles
  - create and use layers
  - manipulate the drawing origin
  - define and utilise symbol libraries
  - utilise grids/grid snaps and object snaps
  - display views at multiple scales
  - add title blocks/frame to layout a drawing for printing
  - prepare advanced drawings in plane orthogonal or equivalent
  - set up prototype drawings
  - define and extract attribute data
  - create bills of materials (BOM) utilising attribute data and third-party application software

## Required knowledge

Required knowledge includes:

- general knowledge of different approaches to drawing
- awareness of copyright and intellectual property issues and legislation in relation to drawing
- environmental and occupational health and safety (OHS) issues associated with the tools and materials used for drawing
- quality assurance procedures
- CAD program capabilities and processes

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use CAD software to produce graphics commonly used in drafting work.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the

<b>unit</b>	<p>competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• identify drawing work requirements and determine appropriate software functions and features</li> <li>• identify features and uses of CAD software used in detail and design drafting</li> <li>• access and use computing equipment and CAD software functions to produce drawing elements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with drafting or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is</p>

	valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
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## Range Statement

<b>CAD software</b>	<p>CAD software may include:</p> <ul style="list-style-type: none"> <li>• AutoCAD</li> <li>• Inventor</li> <li>• Revit</li> <li>• Solidworks</li> <li>• ProSteel</li> <li>• XSteel</li> <li>• other programs</li> </ul>
<b>Key features</b>	<p>Key features may include:</p> <ul style="list-style-type: none"> <li>• 2-D</li> <li>• 3-D modelling</li> <li>• built-in specifications</li> <li>• file import/export</li> <li>• save</li> <li>• undo</li> <li>• scale</li> </ul>
<b>Specific drawing outcomes</b>	<p>Specific drawing outcomes may include</p> <ul style="list-style-type: none"> <li>• 2-D</li> <li>• 3-D modelling</li> <li>• drawings for specific engineering applications</li> <li>• orthographic/isometric/perspectives/schematics</li> </ul>
<b>Basic drawing elements</b>	<p>Basic drawing elements may include:</p> <ul style="list-style-type: none"> <li>• points, line angles, circles, arcs, planes, figures and solids</li> </ul>

	<ul style="list-style-type: none"><li>• squares, rectangles and triangles</li><li>• bisected lines and dividing lines</li><li>• polygon, ellipse, spline, dimension and hatch</li></ul>
<b>Editing and transfer tools and methods</b>	<p>Editing and transfer tools and methods may include:</p> <ul style="list-style-type: none"><li>• delete, fillet, chamfer, erase, trim/extend, break, undo and redo commands</li><li>• zooming and panning</li><li>• moving, copying, rotating and mirroring</li><li>• polar and rectangular duplication</li><li>• object snaps</li><li>• dimensions</li><li>• selecting entities</li><li>• dividing</li><li>• scaling</li><li>• measuring</li><li>• grouping</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

# MEM30032A Produce basic engineering drawings

## Modification History

Release 1 - New unit of competency

## Unit Descriptor

This unit of competency covers producing drawings or similar graphical representations where the critical dimensions and associated tolerances and design specifications are predetermined.

## Application of the Unit

This unit applies to any of the full range of engineering disciplines. All work is carried out under supervision and all specifications, dimensions and tolerances are predetermined. The unit covers application of introductory drafting skills to select and apply drawing protocols.

Manual drafting or computer-aided design (CAD) drawing equipment may be used.

If CAD skills are required, MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements, should be selected.

Drawings are completed to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                               |     |   |
|---|-------------------------------|-----|---|
| 1 | Identify drawing requirements | 1.1 | Identify information requirements for work and obtain all relevant job requirements and design specifications in accordance with workplace procedures |
|   |                               | 1.2 | Identify, interpret and analyse drawing requirements, specifications and relevant workplace information   |
|   |                               | 1.3 | Interpret and apply industry terminology for drawing work   |
|   |                               | 1.4 | Confirm communication practices required during drawing work  |
|   |                               | 1.5 | Estimate time requirements for completing work  |
| 2 | Select drawing features       | 2.1 | Set up drawing list or register   |
|   |                               | 2.2 | Determine level of detail and numbers of drawings required for work   |
|   |                               | 2.3 | Plan presentation and layout, and determine drawing sheets, text style and size, and scales, appropriate for drawing work                             |
|   |                               | 2.4 | Identify features and applications of line types and thicknesses and select for drawing work  |
|   |                               | 2.5 | Establish datums and dimensions   |
| 3 | Prepare and detail drawings   | 3.1 | Prepare drawings in plane orthogonal, isometric projection or equivalent  |
|   |                               | 3.2 | Detail drawings in third angle projection, including auxiliary views, sections and assemblies   |
|   |                               | 3.3 | Draw sections through engineering components incorporating correct use of cutting plane symbols and conventions                                       |



		3.4	Include appropriate symbols for limits and fits, surface texture and geometric tolerances
		3.5	Resolve problems in consultation with a supervisor
		3.6	Check drawing compliance with work instructions and specifications
4	Select physical dimensions and produce engineering parts list	4.1	Where required, select components and/or materials from supplier/manufacturer catalogues using predetermined design specifications
		4.2	Produce an engineering parts list in accordance with workplace procedures
5	Complete drawing documentation	5.1	Obtain approval for drawings and/or parts list
		5.2	Store approved drawings and/or parts lists
		5.3	Catalogue and issue drawing and documentation in accordance with workplace procedures

## Required Skills and Knowledge

### Required skills

Required skills include:

- correctly using and maintaining equipment, including CAD
- manual drafting, filing and printing
- reading and interpreting specifications
- communicating with supervisor to confirm work requirements and outcomes
- visualising components
- preparing a drawing in plane orthogonal, isometric projection or equivalent
- determining drawing protocols required to complete drawing to industry standard
- selecting and locating text to support presentation
- establishing datums and dimensions for drawings
- drawing sections through an engineering component incorporating correct use of cutting plane symbols and conventions

### Required knowledge

Required knowledge includes:

- drafting media, including cartridge paper, tracing paper, drafting film and plain printing paper
- layout conventions
- effective use of blank space, location of notes and symbols
- sectioning
- overview of graphical techniques
- assembly drawings and explosion drawings
- schematics/line drawings, graphs and pictorials
- standard engineering drawing symbols, references and terminology
- application of surface finish symbols to drawings
- uses of different scales in industry applications
- uses and types of line weights
- uses and types of drawing sheets
- type of information provided with drawings

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to produce basic engineering drawings to AS 1100.101–1992 Technical drawing – General principles.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> </ul>

	<ul style="list-style-type: none"> <li>• apply appropriate safety procedures</li> <li>• produce drawings in orthogonal and isometric projection to AS 1100.101–1992 Technical drawing – General principles</li> <li>• produce drawings in third angle projection, including auxiliary views, sections and assemblies</li> <li>• include all details, symbols and notation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with producing basic engineering graphics, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>

## Range Statement

<b>Specifications</b>	<p>Specifications may be obtained from:</p> <ul style="list-style-type: none"> <li>• design information</li> <li>• customer</li> </ul>
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	<ul style="list-style-type: none"><li>• ideas</li><li>• concepts/expectations/requirements</li><li>• sketches</li><li>• preliminary layouts</li></ul>
<b>Drawings</b>	Drawings may include: <ul style="list-style-type: none"><li>• plans</li><li>• diagrams</li><li>• charts</li></ul>
<b>Consultation</b>	Consultation may include <ul style="list-style-type: none"><li>• reference to appropriate personnel, including technical supervisors, manufacturers, suppliers, contractors and customers</li></ul>
<b>Engineering parts list</b>	Engineering parts list may include: <ul style="list-style-type: none"><li>• part name</li><li>• description of part</li><li>• material specification or part number</li><li>• quantities</li><li>• other details, as required</li></ul>
<b>Issued drawings</b>	Issued drawings may include: <ul style="list-style-type: none"><li>• hard copy</li><li>• photographic, slide or transparency form, including presentation as a single drawing and/or with other drawings</li><li>• support documentation as a package</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## **MEM30033A Use computer-aided design (CAD) to create and display 3-D models**

### **Modification History**

Release 1 - New unit of competency

### **Unit Descriptor**

This unit of competency covers using a computer-aided design (CAD) program to produce and plot basic 3-D view drawings.

### **Application of the Unit**

This unit applies to the production of 3-D models using CAD software and associated equipment. This will include the use of region and solid modelling techniques, section views and pre-drawn library files. Work also includes extraction of properties and application of basic rendering techniques.

All work is conducted under supervision.

### **Licensing/Regulatory Information**

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of publication.

### **Pre-Requisites**

MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of

performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Confirm drawing requirements	1.1	Confirm purpose, scope and information and presentation requirements for drawing
		1.2	Identify, interpret and analyse available information relevant to project and work requirements, and identify and address further information needs
		1.3	Identify computing equipment and software used in the organisation
		1.4	Identify work flow and procedures for work supervision and confirm communication requirements through project
		1.5	Examine requirements for presentation of drawings
2	Create and display 3-D views	2.1	Set up a 3-D environment on the screen to allow multiple viewing
		2.2	Create 3-D views on the screen by manipulation of drawing planes and insertion of 3-D geometric shapes
		2.3	Draw on any plane of the 3-D view
		2.4	Use editing functions to modify 3-D geometric shapes in creating 3-D views
		2.5	Produce wire line, surface and solid face displays in isometric, perspective and orthographic projections
3	Detail 3-D model	3.1	Extract the mass and surface area of a given solid model made from a nominated material
		3.2	Apply basic rendering techniques to render solid model to a specified set of criteria
4	Save completed	4.1	Save file in an appropriate format to enable retrieval and

drawing file in  
various formats

use in a CAD system

- 4.2 Save file in other formats to enable retrieval in other software applications

## Required Skills and Knowledge

### Required skills

Required skills include:

- reading and interpreting engineering specifications
- organising information
- using computer and peripherals
- using CAD program
- saving 3-D models in various file formats
- preparing drawings in plane orthogonal, isometric projection or equivalent

### Required knowledge

Required knowledge includes:

- region modelling techniques
- solid modelling techniques
- development of sectioned models
- use of cutting plane
- use of cross hatching
- use of pre-drawn library files and primitives to produce a 3-D model
- use of third level software to produce 3-D models
- how to extract mass and area properties
- how to extract area properties from region models
- application of basic rendering techniques to a 3-D model

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to use CAD to create and display 3-D models.
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<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Specifically the candidate must be able to:</p> <ul style="list-style-type: none"> <li>• work within typical site/teamwork structures and methods</li> <li>• apply worksite communication procedures</li> <li>• comply with organisational policies and procedures, including quality requirements</li> <li>• participate in work meetings</li> <li>• comply with quality requirements</li> <li>• use industry terminology</li> <li>• apply appropriate safety procedures</li> <li>• identify modelling work requirements and determine appropriate software functions and features</li> <li>• apply CAD functions to produce a rendered 3-D model to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with using CAD to create and display 3-D models or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<p><b>Method of assessment</b></p>	<p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways, including direct observation, supervisor's reports, project work,</p>



	samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
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## Range Statement

<b>Multiple viewing</b>	Multiple viewing includes: <ul style="list-style-type: none"><li>• top views</li><li>• front and side views</li><li>• general 3-D view</li></ul>
<b>3-D geometric shapes</b>	3-D geometric shapes may include: <ul style="list-style-type: none"><li>• arcs and lines</li><li>• spheres</li><li>• cones</li><li>• cylinders</li><li>• boxes</li></ul>

## Unit Sector(s)

Drawing, drafting and design

## Custom Content Section

Not applicable.

## MEM50001B Classify recreational boating technologies and features

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers recognising vessel features, fittings and fixtures; correctly identifying power and transmission systems; describing system operating purpose; and using appropriate terminology.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the identification of vessel types and to the classification of vessels according to their main features. It relates to recreational vessels and covers engine and sail powered as well as rowed vessels.</p> <p>The depth of knowledge required is sufficient to be able to identify one vessel from another and to be able to describe its method of propulsion where applicable. Detailed features of hulls, power plants, trailers etc. are covered by other competencies.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p><b>Band: E</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify vessel configurations used in boating applications	1.1.Hull forms and superstructure features are identified. 1.2.Hull designs are matched to normal vessel application. 1.3.Construction materials are identified.
2. Identify and describe the functions of the major systems of a recreational vessel and trailer	2.1.Systems used for vessel propulsion, steering, navigation, communication, services and appliances are identified and functions are explained. 2.2.Trailer components including winching, coupling, load securing, braking, suspension and electrical systems are identified and functions are explained.
3. Use identification information to	3.1.Vessel identification plates and registration tags are

ELEMENT	PERFORMANCE CRITERIA
confirm vessel origins	<p>located.</p> <p>3.2.Engine number, model designation and other details are located and recorded.</p> <p>3.3.Identification data is used to confirm vessel year of manufacture, refurbishment (and/or registration).</p>
4. Identify configuration of motorised propulsion systems	<p>4.1.Vessel power plant(s) are located and categorised for fuel system, number and configuration of cylinders.</p> <p>4.2.Engine cooling and control systems are identified and categorised.</p> <p>4.3.Engine lubricating systems are identified and categorised.</p> <p>4.4.Vessel propulsion (transmission) system is categorised for type and operation.</p> <p>4.5.Operating cycles and cylinder configuration for 2 stroke, 4 stroke, diesel and petrol powered engines are described.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- discerning differences in hull shapes and types as well as construction materials, propulsion and steering systems, power plants, ancillary systems, fittings and fastenings
- reading and interpreting information on identification and compliance plates, registration tags, engine and other component identification numbers
- identifying different types of power plants, engine cooling and lubrication systems and transmission types

#### Required knowledge

Look for evidence that confirms knowledge of:

- typical hull shapes and design features of recreational sail, powered and non-powered craft including but not limited to hard chine, round bilge, planing hulls, multi-hulls, inflatables, rigid and swing keel, centre board

## REQUIRED SKILLS AND KNOWLEDGE

- typical superstructure configurations and general deck layouts of recreational sail, powered and non-powered craft including but not limited to fully open, flush decks, bow riders, half cabins, fly bridges
- typical sail and mast arrangements for recreational sailing craft including but not limited to mast configurations, basic rigging arrangements and sail types such as mainsail, genoa, spinnaker etc.
- construction materials such as glass reinforced plastics and composite materials, aluminium and steel and timber. Timber construction may include clinker, carvel, cold moulded and plywood sheeted etc.
- types of internal combustion engines used for inboard and outboard propulsion systems including two and four cycle, different cylinder layouts, different fuel types including petrol and diesel, liquid or air cooling, starting systems, lubrication methods
- propulsion systems including but not limited to single and multi-screw, jet drives, clutches and gearboxes including stern drives and outboard drives as well as vee drives, bow thrusters
- steering systems including tillers, rods/chains/cable drives, hydraulic, rudder types
- features and functions of attached navigation and communication devices such as navigational lighting, compass, global positioning system, radar, depth sounder, logs, radios, audible alarms
- features and functions of trailer components including winches, couplings, load securing, braking, suspension and electrical systems
- use of information on identification and compliance plates, registration tags, engine and other component identification numbers

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to classify recreational boating technologies and features through the recognition of vessel features/fittings/fixtures, the correct identification of power and transmission systems, and be able to describe system operating purposes and use appropriate terminology.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.


**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## Competency field

Competency field	Boating services
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## MEM50002B Work safely on marine craft

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers identifying risks and safely working on and moving around vessels - for sales, service or repair - on and out of the water.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to recreational vessels in both land and water environments. It also applies to workplaces in which vessels are built, repaired, stored, sold and transported. These workplaces may involve the use of dangerous goods and hazardous materials and may produce noxious waste products.</p> <p>The unit includes skills and knowledge that are particular to a marine environment and are in addition to those safety requirements normally applied in the workplace.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>This unit could be assessed in conjunction with Unit MEM13002B (Undertake occupational health and safety activities in the workplace) and Unit MEM13003B (Work safely with industrial chemicals and materials).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify safe access methods and working platforms	<p>1.1.Appropriate access methods are used to gain access to the work location.</p> <p>1.2.Work platforms are inspected to confirm that they are appropriate for the purpose, are correctly located and comply with any regulatory controls.</p>
2. Move around vessels safely	<p>2.1.Risks and hazards are identified from observation, including confined spaces, and workplace approved risk controls are identified.</p> <p>2.2.Appropriate engineering controls and personal protection equipment for work with recreational vessels are used.</p> <p>2.3.Appropriate warning signs and signals are used.</p>

ELEMENT	PERFORMANCE CRITERIA
3. Work safely on recreational vessels	<p>3.1. Work methods and tools are selected appropriate for the task.</p> <p>3.2. Appropriate engineering controls and personal protection equipment are identified from workplace procedures, and are selected and used.</p> <p>3.3. Work residues are minimised, controlled and disposed of following approved procedures.</p> <p>3.4. Work site is maintained in a clean and tidy state, following approved workplace housekeeping methods.</p>
4. Follow emergency procedures for incidents in the marine environment	<p>4.1. Appropriate responses are used in reaction to incidents and accidents.</p> <p>4.2. Communication systems and methods are used to convey emergency messages.</p> <p>4.3. Drills are followed for fire, explosion, toxic/dangerous spills and leakage, personal illness or injury, man overboard, collision or vessel damage.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- undertaking risk assessment
- communicating with others
- performing proper manual handling techniques
- interpreting safety signage, labelling and placarding

#### Required knowledge

Look for evidence that confirms knowledge of marine environment-specific:

- dangerous goods classification and labelling/placarding
- testing, use and maintenance of PPE
- inherent hazardous properties of the chemicals used
- interpretation of the relevant MSDS
- basic fire fighting procedures

**REQUIRED SKILLS AND KNOWLEDGE**

- site-specific emergency plan procedures
- spill confinement procedures
- dangerous occurrence (near miss) reporting procedures
- hierarchy of control

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to work safely in and on marine craft by identifying any risks, moving and working safely and following emergency procedures.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both. Where assessment occurs off the job, i.e. the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

**EVIDENCE GUIDE**

	observation, supervisor's reports, project work, samples and questioning. Questioning should not require language, literacy and numeracy skills beyond those required in this unit. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Access to the work location</b>	Includes: <ul style="list-style-type: none"> <li>• gang planks</li> <li>• hatches</li> <li>• access ladders</li> <li>• bosun's chairs</li> <li>• rigging</li> </ul>
<b>Work platforms</b>	Work platforms include: <ul style="list-style-type: none"> <li>• purpose built work platforms</li> <li>• mobile and prefabricated scaffold</li> <li>• elevated work platforms</li> </ul>
<b>Engineering controls</b>	These include: <ul style="list-style-type: none"> <li>• ventilation and extraction systems</li> <li>• dust control devices</li> <li>• screens</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Personal protection equipment (PPE)</b>	<p>PPE includes:</p> <ul style="list-style-type: none"> <li>• goggles/face shields</li> <li>• masks or respirators</li> <li>• air supplied or self-contained helmets</li> <li>• appropriate footwear, gloves and appropriate garments</li> <li>• hearing protection</li> <li>• fall arrest devices</li> <li>• UV protection</li> </ul>
<b>Workplace housekeeping methods</b>	<p>Relevant housekeeping methods include:</p> <ul style="list-style-type: none"> <li>• covering/protecting surfaces prior to starting work</li> <li>• returning materials/equipment to storage area</li> <li>• sweeping and cleaning</li> <li>• containment and mopping of spills</li> <li>• appropriate disposal of waste products</li> </ul>
<b>Communication systems and methods</b>	<p>These include:</p> <ul style="list-style-type: none"> <li>• direct voice</li> <li>• megaphone</li> <li>• flares</li> <li>• radio</li> <li>• hand signals</li> <li>• telephone</li> <li>• flags</li> <li>• computer</li> <li>• EPIRB</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Boating services
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## MEM50003B Follow work procedures to maintain the marine environment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers conducting work on vessels or equipment without adversely affecting the quality of the marine environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the protection of marine environments when working on or around recreational vessels. It applies to workplaces in which vessels are built, repaired, stored, sold and transported. These workplaces may involve the use of dangerous goods and hazardous materials and may produce noxious waste products.</p> <p>The unit includes skills and knowledge that are particular to protecting a marine environment and are in addition to those normally applied in the workplace.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>For specific coverage of the limitation, capture and disposal of pollutants in the marine environment see Unit MEM50004B (Maintain quality of environment by following marina codes).</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units	
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## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify from work procedures and personal observation activities that may impact on the environment	1.1. Workplace environment and health and safety procedures are located and used to identify approved work procedures. 1.2. Workplace is observed noting location of drains and interceptors; banded work and storage areas; recyclable, solid and hazardous waste storage; emergency equipment and spill kits; areas where work may impact on the environment; and equipment and practices used to minimise environmental damage and legally dispose of waste.
2. Complete assigned housekeeping duties	2.1. Assigned housekeeping duties are completed following workplace procedures ensuring that waste

ELEMENT	PERFORMANCE CRITERIA
	<p>is correctly removed to appropriate location; any damaged equipment is tagged for maintenance and notified to appropriate personnel; and schedules and records for housekeeping duties are maintained.</p> <p>2.2. Housekeeping duties are carried out following workplace approved safe work practices and procedures.</p>
3. Follow spill clean-up procedures	<p>3.1. Source of spill is identified and stopped if possible and notification is made to appropriate personnel.</p> <p>3.2. Appropriate materials are identified to contain spills including booms, portable bunding, absorbent materials and drain blocks.</p> <p>3.3. Spills are cleaned up following workplace procedures.</p> <p>3.4. Waste is disposed of in appropriate locations and containers.</p>
4. Assist the business to maintain the quality of the environment	<p>4.1. Business environment policy is followed.</p> <p>4.2. Excessive idling and revving of engines is avoided.</p> <p>4.3. Noisy activities are located away from neighbours where possible.</p> <p>4.4. Noise suppression procedures are used where available.</p> <p>4.5. Dust control and waste containment measures are used.</p> <p>4.6. Waste is appropriately collected and disposed.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- locating and interpreting relevant workplace procedures
- assessing work activities that may impact on the environment
- correct use and handling of materials such as fuels, oils, protective coatings, cleaning products

**REQUIRED SKILLS AND KNOWLEDGE**

- identifying sources of potential pollution
- minimising risks of pollution
- containing pollution

**Required knowledge**

Look for evidence that confirms knowledge of:

- identification of pollutants
- procedures to minimise risk of pollution
- procedures for containment of pollution
- overview of applicable environmental legislation

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to conduct work on vessels using sound work practices without adversely affecting the quality of the marine environment.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other

<b>EVIDENCE GUIDE</b>	
	units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Housekeeping duties</b>	<p>Relevant housekeeping duties include:</p> <ul style="list-style-type: none"> <li>• covering/protecting surfaces prior to starting work</li> <li>• returning materials and equipment to appropriate storage</li> <li>• sweeping and cleaning</li> <li>• containment and mopping of spills</li> <li>• appropriate disposal/discharge of waste products</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Boating services
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## MEM50004B Maintain quality of environment by following marina codes

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers workers in the industry controlling pollution through the limitation, capture and disposal of pollutants in the marine environment.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the control of pollution in marine environments when working on or around recreational vessels. It relates to workplaces in which vessels are built, repaired, stored, sold and transported. These workplaces may involve the use of dangerous goods and hazardous materials and may produce noxious waste products and other emissions.</p> <p>The unit includes skills and knowledge that are particular to protecting a marine environment and are in addition to those normally applied in the workplace.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 1</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units		
Path 1	MEM50003B	Follow work procedures to maintain the marine environment

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Assess the environmental implications of the tasks to be conducted	1.1.Tasks to be conducted are listed or work instructions are consulted to establish work requirements. 1.2.Vessel to be maintained is visually inspected to establish any particular potential pollutants. 1.3.Potential pollutants that may be produced as a result of the work are identified.
2. Select work area and method	2.1.Possible work areas are identified for the work and selected to conform with marina/slipway codes and local environmental regulations and to minimise risk of pollution. 2.2.Work method, equipment and materials are selected

ELEMENT	PERFORMANCE CRITERIA
	to minimise impact on the environment. 2.3. Pollution control measures are identified and implemented.
3. Dispose of potential pollutants	3.1. Potential pollutants are classified, separated and collected appropriate to the recycling, treatment or storage system adopted by the business. 3.2. Collected pollutants are disposed of in accordance with regulatory requirements and workplace procedures.
4. Support implementation of marina and slipway environment management plans	4.1. Workplace designated procedures for marina and slipway management are followed. 4.2. Observations of management plan effects and possible implementation improvements are identified and communicated to appropriate personnel. 4.3. Active, positive involvement in implementation of the environment management plan is consistently applied.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying sources of potential pollution
- minimising risks of pollution
- containing pollution

#### Required knowledge

Look for evidence that confirms knowledge of:

- identification of pollutants
- procedures to minimise risk of pollution
- procedures for containment of pollution
- overview of applicable environmental legislation



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to control pollution through the assessment of potential for pollution, limitation, capture and disposal of pollutants in the marine environment and adherence to good practice codes of conduct. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and

**EVIDENCE GUIDE**

	documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Pollutants</b>	<p>Any substance or emission which is deemed to be an undesirable contaminant including:</p> <ul style="list-style-type: none"> <li>• waste water including bilge/black/grey/storm/cleaning water</li> <li>• paint including fumes and overspray</li> <li>• anti fouling flakes or solution</li> <li>• sand or grit from blasting/cleaning</li> <li>• fuel or oil spills</li> <li>• discharges of emulsified oil</li> <li>• domestic waste</li> <li>• noise</li> <li>• smoke and fumes</li> </ul> <p>Note that some of these pollutants contain heavy metals, various hydrocarbons/solvents and other toxicants</p>
<b>Marina</b>	Buildings, wharves and surroundings where vessels are built, stored and maintained
<b>Slipway</b>	Areas where vessels are removed from the water for repair, maintenance or storage

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Boating services
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## MEM50005B Refuel vessels

### Modification History

Not Applicable

### Unit Descriptor

Unit descriptor	This unit covers refuelling vessels and appliances.
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### Application of the Unit

Application of the unit	<p>This unit applies to refuelling recreational vessels in both land and water environments. It relates to workplaces in which vessels are built, repaired, stored, sold and transported.</p> <p>The unit includes skills and knowledge that are particular to refuelling in a marine environment and are in addition to those safety requirements normally applied in the workplace.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p><b>Band: E</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

Prerequisite units		
Path 1	MEM50002B	Work safely on marine craft

<b>Prerequisite units</b>		
	MEM50003B	Follow work procedures to maintain the marine environment

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Match fuels and additives to marine applications	1.1.Fuels are selected to match the engine or appliance. 1.2.Alternative fuel applications are considered. 1.3.Fuel additives and lubricants are selected based on vessel/appliance use and manufacturer requirements.
2. Identify fuel handling risk, precautions and regulatory requirements	2.1.Personal protection for contact with fuels is identified and used. 2.2.Dangers of volatile fuel liquids and vapours are identified. 2.3.Precautions for minimising risks associated with volatile liquids are identified in workplace procedures. 2.4.Procedures to prevent build up of volatile vapours

ELEMENT	PERFORMANCE CRITERIA
	<p>and gases are identified.</p> <p>2.5.Regulatory requirements for refilling portable fuel containers are identified.</p>
3. Identify safety and environmental requirements for fuel refill areas	<p>3.1.Correct locations for refuelling activities are used.</p> <p>3.2.The workplace strategies/procedures to limit danger from static electricity and other sources of ignition are applied.</p> <p>3.3.Protection systems that provide physical barriers to minimise accidental collision with fuelling facilities are identified and used to prevent spills entering drains or the water environment.</p> <p>3.4.Appropriate ventilation is used.</p> <p>3.5.Signage for public safety needs and Hazchem requirements is identified.</p> <p>3.6.Emergency stops and shut-off devices are identified and activation methods are described.</p>
4. Refill fuel containers	<p>4.1.Portable liquid fuel tanks and appliances are refilled.</p> <p>4.2.Gas cylinders are refilled.</p> <p>4.3.On-board fuel tanks are refilled.</p> <p>4.4.Fuel levels are checked for each method of storage.</p> <p>4.5.Emergency procedures for leaks, spills and fire are identified.</p>
5. Replace gas cylinders	<p>5.1.Appliances and pilot lights are turned off.</p> <p>5.2.Gas lines are safely vented after closing gas valves.</p> <p>5.3.Fittings are leak tested after fitting cylinders.</p> <p>5.4.Bottle restraining devices are fitted and adjusted.</p> <p>5.5.Emergency procedures for leaks and fire are identified.</p>
6. Contain and clean up spills	<p>6.1.Potential for spills is identified.</p> <p>6.2.Procedures for notification of spills are followed.</p> <p>6.3.Workplace procedures are followed to contain spill and minimise any environment or safety dangers.</p> <p>6.4.Clean up equipment is identified and used.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

## REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

### Required skills

Look for evidence that confirms skills in:

- identifying correct fuel for the application
- identifying correct lubricant for the application
- selecting appropriate protective equipment
- sourcing and interpreting Hazchem (or similar) requirements
- safely working with fuels and lubricants
- refilling fuel containers and tanks
- checking fuel levels using gauges, dipsticks, sight tubes
- refilling and replacing gas cylinders
- leak testing gas cylinders

### Required knowledge

Look for evidence that confirms knowledge of:

- different fuels and their applications
- personal and environmental dangers associated with fuels and refuelling/filling
- risk minimisation
- use of appropriate personal protective equipment associated with fuels
- selection of appropriate fire fighting equipment
- reduction of vapours
- correct handling of gas cylinders including condition and lifespan
- dealing with spills
- emergency procedures

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to safely refuel marine vessels with the correct fuels, minimise any spills and clean up. They will also be

<b>EVIDENCE GUIDE</b>	
	able to replace and refill portable gas cylinders as well as any other fuelled appliances. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.</p>
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Fuels**

Fuels include all of the hydrocarbon-based fuels such as:

- petrol (gasoline) including premixed two stroke fuel
- diesel (distillate)
- kerosene
- methylated spirits
- lighter fluid/white spirits
- liquefied petroleum gas (LPG)

**Engine or appliance**

May include:

- internal combustion engines used for propulsion or auxiliary power
- stoves
- refrigerators
- heaters
- lights

**Personal protection**

Personal protective equipment can include:

- goggles/face shields
- masks or respirators
- gloves and appropriate clothes/garments

**Contain spill**

Spill containment and clean up can include:

- bunding and drain covers
- chemical dispersal agents
- absorptive materials
- containment booms and portable bunding

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Boating services
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## MEM50006B Check operational capability of marine craft

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers conducting basic checks on the operational condition of vessels in or out of the water.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to checking engine or sail powered recreational vessels in both land and water environments. It relates to workplaces in which vessels are built, repaired, stored, sold and transported.</p> <p>The scope of the unit is limited to identifying and reporting that a vessel is not of its 'normal' appearance at rest on its mooring or berth, or after being brought out of the water. It includes basic operational checks similar to those routinely performed by machinery or vehicle operators. It does not include an assessment of seaworthiness or durability but it does cover watertight integrity. The information would be reported to a supervisor or manager who would determine any further action.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Operational checking of sails and sails systems is covered by Unit MEM50007B (Check operational capability of sails and sail operating equipment).</p> <p><b>Band: E</b></p> <p><b>Unit Weight: 0</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM50002B	Work safely on marine craft

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect hull and fittings	<ul style="list-style-type: none"><li>1.1.Hull bungs and sea cocks are inspected for security and integrity.</li><li>1.2.Hull condition is checked for holes, cracks and deterioration, and extent of marine growth.</li><li>1.3.Fittings and mountings are checked for security and excessive corrosion.</li><li>1.4.Reports of hull and fitting condition are completed on (any) approved workplace documentation and/or</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	reported verbally.
2. Inspect safety equipment	<p>2.1.Vessel safety equipment availability is checked against identified requirements.</p> <p>2.2.Condition of safety equipment is determined and reported if required.</p>
3. Check operating systems	<p>3.1.Propulsion, electrical power, steering, cable and line handling and domestic systems are checked for correct fluid levels, fuel state, lubrication, and visually for mechanical condition and leaks.</p> <p>3.2.Communication equipment is checked for operational status.</p>
4. Inspect cabin and domestic systems	<p>4.1.Cabin fittings are inspected for security and integrity.</p> <p>4.2.Cabin and fittings are checked for holes, cracks and deterioration.</p> <p>4.3.Fittings and mountings are checked for security and condition.</p> <p>4.4.Domestic systems are operated to ensure serviceability.</p> <p>4.5.Reports of cabin and fittings condition are completed on (any) approved workplace documentation and/or reported verbally.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying the general condition of hulls, decks and cabins
- identifying the general condition of fittings and fixtures
- identifying the general condition of safety equipment
- checking engines and other equipment for fluid leaks
- performing visual inspections on lead/acid batteries
- providing simple checklist and verbal reports

#### Required knowledge

## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- general methods of determining condition of hulls, decks, cabins, fittings and fixtures and safety equipment
- methods of determining condition of engines in terms of whether they operate or not
- inspection of lead/acid batteries
- information collation methods to provide a verbal report

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to conduct basic checks on the operational condition of vessels in or out of the water to the extent of providing a simple report to a supervisor or manager. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine

<b>EVIDENCE GUIDE</b>	
	environment, or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Hull and fittings</b>	Surface finish and general condition of the hull inside and out as well as any fittings both above and below the water line where visible
<b>Safety equipment</b>	Flotation devices, communication systems including lights, flares, pumps and bailers, anchor, halyards and chains, EPIRBs, fire extinguishers, torches, lifelines
<b>Identified (safety equipment) requirements</b>	Vessel safety equipment requirements are to be provided by the manufacturer or other authoritative source

<b>RANGE STATEMENT</b>	
<b>Operating systems</b>	Mechanical propulsion systems, communication systems, steering systems, pumping systems, winches and cable handling equipment, ultra low voltage electrical systems operating at 12 or 24 volts d.c.
<b>Domestic systems</b>	Water supply and heating, airconditioning and heating, lighting, cooking, refrigeration, sewage and sullage, entertainment systems

### Unit Sector(s)

<b>Unit sector</b>	
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### Co-requisite units

<b>Co-requisite units</b>		

### Competency field

<b>Competency field</b>	Boating services
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## MEM50007B Check operational capability of sails and sail operating equipment

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers conducting basic checks on vessel sail systems.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to checking the sail equipment of recreational vessels in both land and water environments. It relates to workplaces in which vessels are built, repaired, stored, sold and transported.</p> <p>The scope of the unit is limited to identifying and reporting on the general condition of the sails and their equipment and identifying potential problems that can be easily discerned. It includes basic operational checks similar to those routinely performed by machinery or vehicle operators. It does not include an assessment of seaworthiness or durability. The information would be reported to a supervisor or manager who would determine any further action.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Operational checking of other vessel components is covered by Unit MEM50006B (Check operational capability of marine craft).</p> <p><b>Band: E</b></p> <p><b>Unit Weight: 0</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		
<b>Path 1</b>	MEM50002B	Work safely on marine craft

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Inspect mast(s), boom(s), spars and fittings	1.1.Masts, booms and spars are inspected for security and integrity. 1.2.Fixed rigging is inspected for security and excessive corrosion. 1.3.Fittings and mountings are checked for security and excessive corrosion. 1.4.Reports of masts, booms, spars, rigging and fittings condition are completed on (any) approved

ELEMENT	PERFORMANCE CRITERIA
	workplace documentation and/or reported verbally.
2. Inspect sail condition	<p>2.1.Sails are inspected for tears, rot and deterioration.</p> <p>2.2.Sail runners, cleats and reinforcing points are inspected.</p> <p>2.3.Reports of sails and fittings condition are completed on (any) approved workplace documentation and/or reported verbally.</p> <p>2.4.Sails are correctly stowed after inspection.</p> <p>2.5.Reports of sail condition are completed on (any) approved workplace documentation and/or reported verbally.</p>
3. Check halyards, sheets, ropes and winches	<p>3.1.Halyards, sheets, ropes, cables and winches are inspected for security and integrity.</p> <p>3.2.Halyards, sheets, ropes and cables are secured and/or stowed correctly.</p> <p>3.3.Winches and capstans are checked for operation, lubrication and condition.</p> <p>3.4.Fittings and mountings are checked for security and condition.</p> <p>3.5.Reports of sail control system condition are completed on (any) approved workplace documentation and/or reported verbally.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- identifying the general condition of masts, booms and spars
- identifying the general condition of sails
- identifying the general condition of sail hoisting and trimming equipment
- correctly stowing sails and ropes
- providing simple checklist and verbal reports

#### Required knowledge

**REQUIRED SKILLS AND KNOWLEDGE**

Look for evidence that confirms knowledge of:

- general methods of determining condition of masts, booms and spars
- methods of determining condition of sails and hoisting/trimming equipment in terms of whether they operate or not, are frayed or showing signs of distress etc.
- information collation methods to provide a verbal report

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to conduct basic checks on the operational condition of vessel sails and fittings/equipment in or out of the water to the extent of providing a simple report to a supervisor or manager. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the

<b>EVIDENCE GUIDE</b>	
	skills and knowledge covered by this unit.
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Masts, booms and spars</b>	Wood, aluminium and composite materials
<b>Halyards, sheets, ropes, cables and winches</b>	Halyards, ropes, wires, cables, shackles, turning blocks, electric and hand powered winches, self-steer systems and self-furling sail systems

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Boating services
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## MEM50008B Carry out trip preparation and planning

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers undertaking the required steps to plan and prepare for a safe boating trip. It includes maintenance of the boat and safety equipment as well as mooring and berthing apparatus.</p> <p>This unit was developed by the National Marine Safety Committee (NMSC).</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is one of three core competencies that have been adopted by all government marine safety authorities to contribute to and promote the safe use of waterways and awareness of boating safety. The unit applies specifically to mechanical powered recreational boats including personal watercraft. However, it is recognised that some aspects of this competency apply to any recreational vessel.</p> <p>This unit applies to checking the vessel and planning for a particular boating trip.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>General operational checks and basic assessment of the condition of a vessel are covered by Units MEM50006B (Check operational capability of marine craft) and MEM50007B (Check operational capability of sails and sail operating equipment).</p> <p>Unit MEM50009B (Safely operate a mechanically powered recreational boat) and Unit MEM50010B (Respond to boating emergencies and incidents) are the other two NMSC core units.</p>
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	<b>Band: E</b> <b>Unit Weight: 0</b>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

Prerequisite units	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Maintain the boat	1.1. Boat is maintained/serviced on a regular basis.



ELEMENT	PERFORMANCE CRITERIA
and safety equipment	1.2.Safety equipment complies with relevant legislation. 1.3.Safety equipment is serviceable and accessible, and its location is identified and securely and appropriately stowed.
2. Maintain mooring and berthing apparatus	2.1.Mooring and berthing apparatus is maintained/serviced on a regular basis. 2.2.Mooring apparatus is appropriate to the vessel and location.
3. Plan trip	3.1.Weather conditions, vessel and personnel are checked for suitability for planned trip. 3.2.Trip activity plan takes into account area and type of operation and emergency contact. 3.3.Adequate provisions, including fuel, for trip are carried out. 3.4.Trip details are communicated to appropriate person. 3.5.Check is made to ensure the number of passengers does not exceed boat design limitations and/or legislative requirements. 3.6.Check is made to ensure equipment, stores and personal items are securely stowed and do not adversely affect the boat's stability. 3.7.Appropriate person is informed of safe return from the activity.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- interpreting weather forecasts

#### Required knowledge

Look for evidence that confirms knowledge of:

- weather information
- vessel maintenance and service schedule requirements

**REQUIRED SKILLS AND KNOWLEDGE**

- capabilities of boat
- safety equipment required on-board boat
- safety procedures
- marine legislation, regulations and rules
- area of activity
- legislative requirements regarding the use of safety equipment

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to undertake the required steps to plan and prepare for a safe boating trip, including undertaking simple maintenance.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality and communication, associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Boat is maintained/serviced</b>	Oil levels and mix, belts, spark plugs, regular running and flushing of cooling system where appropriate, manual starting, raw water intake filters, fuel lines, fillers and tanks, hoses, maintenance history and compliance with maker recommendations, electrical wiring, battery and master switch/Dead Man's switch, steerage, propeller and shaft condition
<b>Safety equipment</b>	Life jackets, bailers, dinghy/life raft, paddles/oars, bilge pumps, bucket and line, first aid kit, fire extinguisher, distress signalling equipment, marine radio, waterproof torch, charts, anchor/sea anchor, lifebuoy, compass, sound signal, drinking water, towing harness, isolating switches, tow

<b>RANGE STATEMENT</b>	
	rope, local emergency procedures book, sounding equipment, EPIRB, GPS, divers flag, suitable clothing, alternative means of propulsion
<b>Mooring and berthing apparatus is maintained/serviced</b>	Appropriateness of mooring/berthing, regularity of checks, services by recognised contractor, serviceable mooring and berthing lines, fenders, anchors and ground tackle
<b>Weather conditions</b>	Current forecast, wind, latest weather and conditions information, source of weather information, tides (flood and ebb tides), rips and bars, wave height, visibility, day/night
<b>Area and type of operation</b>	Hazards, local knowledge, rules and protocols, events, emergency response, access and exit points, safe havens, launching ramps, destination port
<b>Adequate provisions</b>	Suitability of the vessel for the activity, adequate fuel for the distance, water, food, ice, sun protection, wet weather gear, first aid kit, personal medications, batteries, gas, emergency (reserve) fuel and method of fuel transfer
<b>Trip details</b>	Trip departure and return time, number of people in the boat, area and nature of operation, way points, radio used and frequency, call signs, details of vessel including description and registration number, shore contact details, fuel capacity and usage, trailer registration number
<b>Appropriate person</b>	Family member or relative, neighbour(s), police - water or local, marine rescue services, club or organisation, harbour master, coastal radio station, note in car (if appropriate)
<b>Pre-start check</b>	Fuel is connected, battery is charged and connected, kill switch, fumes, petrol, fuel and water leaks, open hatches/windows/doors, ventilation, sea-cock opening, secure loose gear, turn on marine radio, check bilge water levels, navigation lights, raise radio aerials

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Boating services
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## MEM50009B Safely operate a mechanically powered recreational boat

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers safely handling/operating a powered recreational boat on coastal and inland waters. It includes manoeuvring and handling the boat as well as safe navigation and anchoring.</p> <p>This unit was developed by the National Marine Safety Committee (NMSC).</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is one of three core competencies that have been adopted by all government marine safety authorities to contribute to and promote the safe use of waterways and awareness of boating safety. The unit applies specifically to mechanical powered recreational boats including personal watercraft. However, it is recognised that some aspects of this competency apply to any recreational vessel.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Unit MEM50008B (Carry out trip preparation and planning) and Unit MEM50010B (Respond to boating emergencies and incidents) are the other two NMSC core units.</p> <p><b>Band: A</b></p> <p><b>Unit Weight: 2</b></p>
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## Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Manoeuvre and handle the boat	<ul style="list-style-type: none"><li>1.1.A pre-start check is undertaken.</li><li>1.2.Motor is prepared and started.</li><li>1.3.Boat is manoeuvred safely according to conditions and in accordance with water traffic regulations.</li><li>1.4.Performance of the boat and personnel is monitored at all times.</li><li>1.5.Impact of boat use on others and the environment is considered.</li></ul>

ELEMENT	PERFORMANCE CRITERIA
	1.6.Safety equipment is used, stowed and, if required, worn in accordance with legislation and recognised regulations and rules.
2. Navigate safely	2.1.Aids to small craft navigation are identified. 2.2.Collision avoidance techniques are applied when required in accordance with relevant legislation, recognised regulations and rules. 2.3.Operation of the boat is carried out at all times in accordance with relevant legislation, recognised regulations and rules. 2.4.Navigational aids and landmarks are used to determine and monitor boat position. 2.5.Hazards and conditions are taken into account in navigating the boat.
3. Anchor the boat	3.1.Anchorage site is selected in accordance with prevailing and forecast conditions and in accordance with legislation. 3.2.Type of anchor used is suitable for location. 3.3.Anchor is lowered, set and monitored according to prevailing conditions. 3.4.Anchor is retrieved and securely stowed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- adequately preparing and checking
- manoeuvring and handling a boat safely and accurately
- monitoring performance and being aware
- navigating safely and taking hazards into account
- anchoring techniques

#### Required knowledge



## REQUIRED SKILLS AND KNOWLEDGE

Look for evidence that confirms knowledge of:

- boating and other relevant legislation, rules and regulations
- legislative requirements regarding the use of safety equipment
- area of activity hazards and prevailing conditions
- boating information resources
- environmental awareness

## Evidence Guide

### EVIDENCE GUIDE

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competency in this unit must be able to safely handle/operate a powered recreational boat on coastal and inland waters, including basic navigation and anchoring.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

#### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.

**EVIDENCE GUIDE****Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.

**Guidance information for assessment****Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Pre-start check**

Pre-start check may include:

- fuel is connected
- battery is charged and connected
- kill switch
- fumes, petrol
- fuel and water leaks
- hatches/windows/doors are open
- ventilation
- sea-cock opening
- loose gear is secured
- marine radio is turned on and radio aerials raised
- bilge water levels checked

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• navigation lights</li> </ul>
<b>Manoeuvred safely according to conditions</b>	<ul style="list-style-type: none"> <li>• Manoeuvring conditions may include:             <ul style="list-style-type: none"> <li>• from or to a ramp, pontoon, wharf, mooring, anchor, confined areas such as narrow channels, marinas, moorings, obstructions</li> <li>• sea-states such as bars, waves, rips, high seas, tidal surges, choppy conditions, wakes</li> <li>• low speed/high speed</li> <li>• poor visibility</li> <li>• effect of wind</li> <li>• large vessels</li> </ul> </li> <li>• Safe manoeuvring may include:             <ul style="list-style-type: none"> <li>• steer straight line</li> <li>• astern</li> <li>• figure-eight</li> <li>• right of way</li> <li>• port-starboard</li> <li>• throttle control</li> <li>• emergency stop</li> <li>• trim and stability of vessel</li> <li>• towing or being towed</li> <li>• berthing</li> <li>• standing-on/stemming the tide</li> <li>• retrieval of person overboard</li> </ul> </li> </ul>
<b>Monitored</b>	<p>Monitoring may include:</p> <ul style="list-style-type: none"> <li>• cooling system</li> <li>• bilge</li> <li>• portholes and hatches</li> <li>• location and welfare of persons on board</li> <li>• oil, fuel and water</li> <li>• radio</li> <li>• position of boat</li> <li>• other water users</li> <li>• battery and electrical systems</li> </ul>
<b>Environment</b>	<p>Impact of boat use on others/environment may include:</p> <ul style="list-style-type: none"> <li>• noise</li> <li>• wake</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• safety of others</li> <li>• disturbance or injury to wildlife</li> <li>• disposal of waste and bilge water</li> <li>• effects of detergent and anti-foul</li> <li>• fuelling arrangements</li> </ul>
<b>Aids to small craft navigation</b>	<p>Aids to navigation may include:</p> <ul style="list-style-type: none"> <li>• IALA Buoyage System 'A'</li> <li>• charts</li> <li>• compasses</li> <li>• GPS</li> <li>• sounder</li> <li>• tide tables</li> <li>• passage plan</li> <li>• marine references</li> <li>• notices to mariners</li> <li>• radio navigational warnings</li> </ul>
<b>Relevant legislation, recognised regulations and rules</b>	<ul style="list-style-type: none"> <li>• Collision regulations such as: <ul style="list-style-type: none"> <li>• navigating in narrow channels</li> <li>• giving way to other vessels</li> <li>• overtaking, proper lookout</li> <li>• sound signals</li> <li>• lights and shapes</li> <li>• responsibilities and duty of care</li> <li>• use of buoyage system</li> <li>• speed</li> <li>• recognition of lights and markers</li> <li>• rules of road</li> <li>• recognition of operation areas</li> <li>• specific activity rules, e.g. PWCs, water skis, equipment requirements</li> <li>• accident/incident reporting</li> </ul> </li> <li>• Marine regulations such as: <ul style="list-style-type: none"> <li>• safety regulations</li> <li>• licensing and registration</li> <li>• speed limit restrictions</li> <li>• distance off requirements</li> <li>• port limits/rules</li> <li>• marine incident reporting</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• carrying capacity</li> <li>• drug and alcohol limits/effects</li> <li>• age of operators</li> <li>• Environmental and wildlife regulations as relevant and applicable to the operation of boats</li> </ul>
<b>Hazards and conditions</b>	<p>Hazards and conditions may include:</p> <ul style="list-style-type: none"> <li>• weather</li> <li>• set and drift</li> <li>• effect of wind, tide and currents</li> <li>• submerged objects</li> <li>• other boats and wash</li> <li>• restricted waters</li> <li>• crossing bars</li> </ul>
<b>Type of anchor</b>	<ul style="list-style-type: none"> <li>• Types of anchor may include: <ul style="list-style-type: none"> <li>• Danforth</li> <li>• Grapnel/Reef</li> <li>• Bruce</li> <li>• Plough</li> <li>• Admiralty</li> <li>• Sarca</li> <li>• sea anchor</li> </ul> </li> <li>• Anchoring systems may include: <ul style="list-style-type: none"> <li>• multiple anchors</li> <li>• bow and stern anchors</li> <li>• mooring buoy</li> </ul> </li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Co-requisite units

Co-requisite units		

## Competency field

Competency field	Boating services
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## MEM50010B Respond to boating emergencies and incidents

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers dealing with boating emergencies and incidents including the use of safety equipment and the provision of assistance to others in distress. It also includes raising alarms and dealing with on-board emergencies.</p> <p>This unit was developed by the National Marine Safety Committee (NMSC).</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is one of three core competencies that have been adopted by all government marine safety authorities to contribute to and promote the safe use of waterways and awareness of boating safety. The unit applies to all recreational boats including personal watercraft.</p> <p>All work and work practices are undertaken to regulatory and legislative requirements.</p> <p>Unit MEM50008B (Carry out trip preparation and planning) and Unit MEM50009B (Safely operate a mechanically powered recreational boat) are the other two NMSC core units.</p> <p><b>Band: E</b></p> <p><b>Unit Weight: 0</b></p>
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### Licensing/Regulatory Information

Not Applicable

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Use safety equipment	<p>1.1.Nature, type, location, accessibility and serviceability of safety equipment is known and understood by all personnel on board.</p> <p>1.2.Briefing of personnel is conducted before departure.</p> <p>1.3.Safety equipment is used in a manner appropriate to the emergency or incident.</p> <p>1.4.Safety equipment is used for the purpose for which it was designed.</p>
2. Raise alarms	<p>2.1.Nature of emergency is identified.</p> <p>2.2.Alarm is communicated to on-board personnel.</p> <p>2.3.Recognised distress signals are used to indicate need of assistance.</p>



ELEMENT	PERFORMANCE CRITERIA
3. Deal with on-board emergency	3.1. On-board personnel are informed of actions required to deal with the emergency. 3.2. Procedures are implemented to combat emergency and protect persons on board. 3.3. Position is identified, recorded and communicated. 3.4. Injured persons are provided with assistance. 3.5. Communication with rescuers is maintained. 3.6. Preparation for abandoning the boat is undertaken, if required. 3.7. Cessation of emergency is communicated to appropriate personnel.
4. Assist others in distress	4.1. Distress signals from others are recognised. 4.2. Nature of assistance required is identified. 4.3. Capability to safely assist or relay emergency is determined taking into account own safety and physical proximity to the emergency incident. 4.4. Appropriate response to the emergency is prepared for and implemented. 4.5. Cessation of emergency incident is communicated to appropriate personnel.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Look for evidence that confirms skills in:

- correctly using safety equipment
- delegating skills
- communicating
- using leadership skills
- applying first aid

#### Required knowledge

Look for evidence that confirms knowledge of:

**REQUIRED SKILLS AND KNOWLEDGE**

- range of safety equipment
- common emergency actions
- types of boating emergency incidents and situations
- boating legislation, regulations and rules

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competency in this unit must be able to deal with boating emergencies and incidents including the use of safety equipment, raising alarm and assisting others in distress.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

**Context of and specific resources for assessment**

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling associated with a marine environment, or other units requiring the exercise of the skills and knowledge covered by this unit.

**Method of assessment**

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct

<b>EVIDENCE GUIDE</b>	
	observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Briefing</b>	<p>Briefing information may include:</p> <ul style="list-style-type: none"> <li>• vessel operation</li> <li>• personnel assessment such as swimming skills, boating knowledge, medication and dietary requirements</li> <li>• location and use of safety equipment</li> <li>• emergency procedures</li> <li>• abandoning procedures</li> </ul>
<b>Emergency</b>	<p>Emergencies may include:</p> <ul style="list-style-type: none"> <li>• fire (smoke or heat)</li> <li>• grounding</li> <li>• person overboard</li> <li>• person retrieval from water</li> <li>• capsize</li> <li>• swamping</li> <li>• sinking</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"><li>• engine/motor breakdown or malfunction</li><li>• fouled propeller</li><li>• anchoring</li><li>• flooding</li><li>• lost</li><li>• injuries/illness</li><li>• hypothermia</li><li>• lack of fuel</li><li>• contaminated fuel</li></ul>
<b>Distress signals</b>	<p>Distress signals may include:</p> <ul style="list-style-type: none"><li>• pyrotechnic distress flares</li><li>• flags</li><li>• radio</li><li>• hand signals</li><li>• dye markers</li><li>• International Code Signal of Distress</li><li>• sound signal including voice</li><li>• EPIRB</li><li>• V-sheet</li><li>• reflective mirror</li><li>• light signals</li><li>• mobile phone</li></ul>
<b>Preparation for abandoning</b>	<p>Preparation for abandoning includes:</p> <ul style="list-style-type: none"><li>• brief on-board personnel</li><li>• take drinking water</li><li>• don of life jackets</li><li>• identify location of vessel</li><li>• communicate to rescuers actions taken or to be taken</li><li>• assess and ensure readiness of life rafts/life rings</li><li>• activate EPIRB</li><li>• identify and collect emergency equipment, provisions and clothing</li><li>• deploy anchor or sea anchor</li></ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

**Competency field**

<b>Competency field</b>	Boating services
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## AURVTN2002 Carry out panel repairs

### Modification History

Release	Comment
Release 1	Replaces AURV225908A Carry out panel repairs Unit code updated to meet policy requirements Reference to OHS legislation replaced with new WHS legislation Licensing statement added to unit descriptor

### Unit Descriptor

Unit descriptor	<p>This unit of competency covers the skills and knowledge required to carry out panel repairs to pre-paint condition. Repairs of body panels in this unit are limited to small repairs to accident damage, including dents.</p> <p>Licensing, legislative, regulatory or certification requirements may apply to this unit in some jurisdictions. Users are advised to check with the relevant regulatory authority.</p>
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### Application of the Unit

Application of the unit	<p>The unit includes identification and confirmation of work requirements, preparation for work, completion of panel repairs, application of fillers, application of protective coatings, and completion of work finalisation processes, including clean-up and documentation.</p> <p>Work requires individuals to demonstrate judgement and problem-solving skills in managing own work activities and contributing to a productive team environment.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare for work	1.1. Work instructions are used to determine job requirements, including quality, material, equipment and quantities. 1.2. Job specifications are read and interpreted. 1.3. Workplace health and safety (WHS) requirements, including breathing protection, personal protection needs, are observed throughout the work. 1.4. Material for application is selected and inspected for quality. 1.5. Hand and power tooling are identified and checked for safe use. 1.6. Products are determined to minimise waste material. 1.7. Procedures are identified for maximising energy efficiency while completing job.
2. Carry out panel repairs	2.1. Information is accessed and interpreted from manufacturer/component supplier specifications. 2.2. Components are repaired using approved methods and equipment in accordance with

ELEMENT	PERFORMANCE CRITERIA
	<p>manufacturer/component supplier specifications.</p> <p>2.3. Where repair of components includes disturbance to electrical, mechanical, air conditioning systems or trim, authorised assistance is sought where required.</p> <p>2.4. Repairs are carried out to pre-paint condition.</p> <p>2.5. Repair activities are carried out according to industry regulations/guidelines, WHS requirements, legislation and enterprise procedures/policies.</p>
3. Carry out repairs using body fillers	<p>3.1. Information is accessed and interpreted from manufacturer/component supplier specifications.</p> <p>3.2. Components are repaired using approved methods and equipment in accordance with manufacturer/component supplier specifications.</p> <p>3.3. Repairs are carried out to pre-paint condition.</p> <p>3.4. Repair activities are carried out according to industry regulations/guidelines, WHS requirements, legislation and enterprise procedures/policies.</p>
4. Clean up work area and Maintain equipment	<p>4.1. Material that can be reused is collected and stored.</p> <p>4.2. Waste and scrap is removed following workplace procedures.</p> <p>4.3. Equipment and work area are cleaned and inspected for serviceable conditions in accordance with workplace procedures.</p> <p>4.4. Unserviceable equipment is tagged and faults identified in accordance with workplace procedures.</p> <p>4.5. Operator maintenance is completed in accordance with manufacturer/component supplier specifications and worksite procedures.</p> <p>4.6. Tooling is maintained in accordance with workplace procedures.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:



**REQUIRED SKILLS AND KNOWLEDGE**

- collect, organise and understand information related to body repairs and work orders, plans and safety procedures for panel repairs
- communicate ideas and information to enable confirmation of work requirements and specifications, coordination of work with worksite supervisor, other workers and customers, and reporting of work outcomes and problems
- plan and organise activities, including preparation and layout of worksite and obtaining of equipment and material to avoid backtracking, workflow interruptions or wastage
- work with others and in a team by recognising dependencies and using cooperative approaches to optimise workflow and productivity
- establish safe and effective work processes which anticipate and/or resolve problems and downtime, to systematically develop solutions to avoid or minimise reworking and wastage
- use mathematical ideas and techniques to complete measurements and estimate material requirements required for the work
- use workplace technology related to completing small repairs to panels, including use of specialist tooling, measuring equipment, use of communication devices and reporting/ documenting of results

**Required knowledge**

Required knowledge includes:

- WHS regulations/requirements, equipment, material and personal safety requirements
- types of body fillers and applications
- types of adhesives
- types of abrasives
- equipment maintenance procedures
- basic body filler repair procedure
- basic panel beating
- workplace guidelines regarding tolerance levels
- procedures for reporting faults and material defects
- work organisation and planning processes
- enterprise quality processes

**Evidence Guide****EVIDENCE GUIDE**

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that competence is fully observed and there is ability to transfer competence to changing circumstances and to respond to unusual situations in the critical aspects of:</p> <ul style="list-style-type: none"> <li>• observing safety procedures and requirements</li> <li>• communicating effectively with others involved in or affected by the work</li> <li>• selecting methods and techniques appropriate to the circumstances</li> <li>• completing preparatory activity in a systematic manner</li> <li>• reading and interpreting job sheets and filler material safety data sheets to prepare for work</li> <li>• identifying and selecting material used in the work process</li> <li>• identifying, setting up, operating and maintaining panel repair equipment and procedures to complete the following: <ul style="list-style-type: none"> <li>• small panel repairs</li> <li>• application of fillers</li> <li>• application of protective coatings.</li> </ul> </li> </ul>
<b>Context of, and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Application of competence is to be assessed in the workplace or simulated worksite.</li> <li>• Assessment is to occur using standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Assessment is to comply with regulatory requirements, including Australian standards.</li> <li>• The following resources should be made available: <ul style="list-style-type: none"> <li>• workplace location or simulated workplace</li> <li>• material relevant to completing small repairs to panels</li> <li>• equipment, hand and power tooling appropriate to completing small repairs to panels</li> <li>• activities covering mandatory task requirements</li> <li>• specifications and work instructions.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy endorsed Assessment Guidelines of the Automotive Industry Retail, Service and Repair Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of</li> </ul>

**EVIDENCE GUIDE**

	<p>underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment must be by direct observation of tasks, with questioning on underpinning knowledge and it must also reinforce integration of key competencies.</li> <li>• Assessment may be applied under project-related conditions and require evidence of process.</li> <li>• Assessment must confirm a reasonable inference that competence is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• It is preferable that assessment reflects a process rather than an event and occurs over a period of time to cover varying quality circumstances. Evidence of performance may be provided by customers, team leaders/members or other persons subject to agreed authentication arrangements.</li> <li>• Competence in this unit may be assessed in conjunction with other functional units which together form part of the holistic work role.</li> </ul>
<b>Guidance information for assessment</b>	

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Repairs**

Repairs of body panels in this unit are limited to small repairs to accident damage, including dents

**Repair methods**

Repair methods are to include:

- panel and trim removal
- heating, welding, filling and finishing
- preparation of panels to pre-paint condition

<b>RANGE STATEMENT</b>	
<b>WHS</b>	<p>WHS requirements are to be in accordance with legislation/regulations/codes of practice and enterprise safety policies and procedures. This may include:</p> <ul style="list-style-type: none"> <li>• protective clothing and equipment</li> <li>• use of tooling and equipment</li> <li>• workplace environment and safety</li> <li>• handling of material</li> <li>• use of firefighting equipment</li> <li>• enterprise first aid</li> <li>• hazard control and hazardous material and substances</li> </ul>
<b>Personal protective equipment</b>	<p>Personal protective equipment is to include that prescribed under legislation/regulation/codes of practice and workplace policies and practices</p>
<b>Safe operating procedures</b>	<p>Safe operating procedures are to include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• operational risk assessment and treatments associated with vehicular movement, toxic substances, electrical safety, machinery movement and operation, manual and mechanical lifting and shifting, working in proximity to others and worksite visitors</li> </ul>
<b>Emergency procedures</b>	<p>Emergency procedures related to this unit are to include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• emergency shutdown and stopping of equipment</li> <li>• extinguishing fires</li> <li>• enterprise first aid requirements</li> <li>• worksite evacuation</li> </ul>
<b>Environmental requirements</b>	<p>Environmental requirements are to include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• waste management, noise, dust and clean-up management</li> </ul>
<b>Quality requirements</b>	<p>Quality requirements are to include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• regulations, including Australian standards</li> <li>• internal company quality policies and</li> </ul>

<b>RANGE STATEMENT</b>	
	standards <ul style="list-style-type: none"> <li>• enterprise operations and procedures</li> </ul>
<b>Statutory/regulatory authorities</b>	Statutory/regulatory authorities may include: <ul style="list-style-type: none"> <li>• federal, state/territory and local authorities administering applicable Acts, regulations and codes of practice</li> </ul>
<b>Tooling and equipment</b>	Tooling and equipment may include: <ul style="list-style-type: none"> <li>• hand and power tooling</li> <li>• vehicle protection</li> <li>• templates</li> <li>• welding and heating equipment</li> <li>• specialist tooling and lifting equipment</li> </ul>
<b>Materials</b>	Materials may include: <ul style="list-style-type: none"> <li>• fillers, adhesives, abrasives, primers and cleaning materials</li> </ul>
<b>Communications</b>	Communications are to include, but are not limited to: <ul style="list-style-type: none"> <li>• verbal and visual instructions and fault reporting and may include worksite specific instructions, written instructions, plans or instructions related to job/task, telephones and pagers</li> </ul>
<b>Information/documents</b>	Sources of information/documents may include: <ul style="list-style-type: none"> <li>• verbal or written and graphical instructions, signage, work schedules/plans/specifications, work bulletins, memos, material safety data sheets, diagrams or sketches</li> <li>• safe work procedures related to completing small repairs to panels</li> <li>• regulatory/legislative requirements pertaining to automotive industry, including Australian Design Rules</li> <li>• engineer's design specifications and instructions</li> <li>• workplace specifications and requirements</li> <li>• instructions issued by authorised enterprise or external persons</li> <li>• Australian standards</li> </ul>

## Unit Sector(s)

Unit sector	Vehicle body
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## Co-requisite units

Not applicable.

## Competency field

Competency field	Technical - Body
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## Modification History

Not Available

## INTRODUCTION

This Unit covers the maintenance of trust monies related to specific files, under the instruction of a legal practitioner.

Note: It may be illegal for a person without a current legal practice certificate to provide legal advice, to sign off on legal work and receive trust account monies. The use of trust account monies is subject to legislative control. Accordingly work carried out in regard to trust account monies occurs under the instruction of a legal practitioner and is of a complex but specified nature. Therefore the position of this unit at AQF Level 4 is in relation to the level of responsibility and technical complexity required in the tasks involved.

This unit can be assessed alone or in combination with other units making up a job role.

### Element

Check that trust funds are adequate

### Performance Criteria

- Relevant sources are checked for information regarding disbursements and costs
- Estimated disbursements and costs are calculated and reconciled with available trust funds
- Instructing legal practitioner is notified where there are inadequate available funds

- Client is notified that further funds are required, where necessary, according to a firm's policies and procedures
- Draw cheque/s against the trust account
- Appropriate requisition form is completed
  - Authorisation is gained from instructing legal practitioner according to a firm's policies and procedures
  - Cheque/s are inspected for accurate amount and correct account source
  - Instructing legal practitioner is organised to verify and sign cheques
  - Accurate records are kept of all file related disbursements and costs
- Prepare documentation upon completion of legal matter
- Relevant information/documentation from file is collated
  - Monies remaining in trust account are reconciled
  - Discrepancies/irregularities are investigated promptly and appropriate follow up action is taken

## RANGE OF VARIABLES

Relevant information sources may include:

- information from open file
- monies received into the trust account
- transactions on the trust account
- petty cash vouchers
- petty cash book
- purchase requisitions and orders
- invoices and receipts
- delivery dockets
- credit notes
- statements
- cheques
- deposit books
- bank statements

Disbursements may include:

- filing fees
- photocopying
- postage
- cost of duty stamps

- court costs
  - telephone charges
- Trust account procedures may include:
- arrangements with banks to prevent the following deductions from trust accounts
    - FID Tax
    - BAD Tax
    - Bank charges
  - reporting to state law society/institute as required by law
- Methods for maintaining trust accounts may include:
- hard copy
  - standard books of account
  - specialised software
- Details to be completed on requisition form include:
- file/matter number
  - amount
  - description of reason for cheque or receipt
  - authorisation/signatures of designated person
- Recording mechanisms/systems may:
- be paper-based
  - be electronic
  - vary according to a firm's accounting system
  - vary according to bank requirements
- A firm's accounting system may:
- be paper-based
    - cash books
    - journals
  - be electronic
    - commercial software package
    - customised software package
  - vary according to a firm's accounting system
  - vary according to bank requirements
- Financial documentation for clients may include:
- statement of accounts
  - calculation of fees
  - copies of receipts
- A firm's policies and procedures may include:
- bank procedures and policies
  - notifying client when further funds are required
  - keeping records of disbursements



- following up discrepancies and irregularities
- information sources
- accessing accounting system
- security/confidentiality/privacy procedures
- verifying and authorising information
- recording information
- handling monies
- liaising with financial institutions
- legal bookkeeping

The area of law may include\*:

- commercial law
- corporate law
- criminal law
- family law
- industrial relations/employment law
- property law
- tax law
- litigation
- wills and probate

\* These are nine common areas of law. The area of law is not restricted to this list; other areas of law may be applicable.

Legislative requirements may relate to:

- relevant State/Territory/Commonwealth legislation
- Governing legal practice Acts in each State/Territory
- the client and a firm (eg. Consumer Credit Code, Privacy Act, secrecy laws, Codes of Practice, common law and Statutory Duties of Care involving financial relationships)
- the area of law
- schedules of fees and duties payable
- establishing a trust account
- taxation and banking requirements
- tort, equity and statute law
- Australian Taxation Office regulations

Relevant State/Territory/Commonwealth legislation may include:

- Trade Practices Act
- Small Debts Act
- Bills of Exchange Act

- Financial Transactions Report Act
- various state's conduct acts, eg. Legal Practice Act

## EVIDENCE GUIDE

- Critical aspects:
- understanding of scope of own responsibility is demonstrated
  - an understanding of trust accounting principles and practices within the limits of the employee's responsibilities is demonstrated
  - an understanding of a firm's trust and general accounting procedures is demonstrated
  - correct usage of different types of documents is demonstrated
  - documentation is filled out correctly and presented to instructing legal practitioner within agreed timelines
  - records of disbursements are accurate and up-to-date, according to a firm's policies and procedures
  - evidence of knowledge of the type of discrepancies and irregularities which could arise and standard resolutions
  - discrepancies and irregularities are resolved within scope of own responsibility and those outside of own responsibility are referred immediately to instructing legal practitioner, eg. files with inadequate funds
  - calculations and reconciliations are checked for accuracy
  - numerical information is checked
  - contact with client regarding inadequacy of funds is handled sensitively and according to a firm's policies and procedures
  - legal actions, legislative requirements and invoicing procedures are explained to client in simple language, where appropriate
  - check for written authorisation from client and instructing legal practitioner is obtained when moving trust account money into interest bearing account
  - documentation prepared at the completion of a legal matter is complete and accurate
  - file/matter number is attached to all relevant documentation and such documentation is filed appropriately
  - a firm's trust accounting procedures, legislative and regulatory requirements are complied with
  - non-disclosable information is not communicated and where any doubt exists as to the information's status it is not disclosed
  - activities, actions and outcomes are documented and time is recorded

- honesty and integrity are demonstrated in all financial dealings
- all work is conducted within accepted codes of conduct including those relating to: maintaining confidentiality, use of company property, duty of care, ethical behaviours, privacy, non-discriminatory practice, conflict of interests and compliance with reasonable direction
- reports in relation to trust monies are compiled and reviewed in line with firm's policies and procedures

**Resource implications:** The assessor must have access to appropriate documentation and resources normally found in the work environment and required to allow the job or task to be properly performed. These may include:

- appropriate legislation and regulations relevant to assisting clients, maintaining business accounts, maintaining trust accounts and transferring trust monies
- workplace manuals and reference materials such as company policy, procedural manuals and checklists
- appropriate technology such as computers with relevant software calculators, adding machines and imprinters

**Consistency in performance:** This unit of competency will require evidence to be collected across a range of events, eg. dealing with trust account requirements, and over a period of time to ensure that situational variables are consistently achieved.

**Context of assessment:** Evidence of competency can be met in different situations, including:

- on the job assessment
- off the job assessment
- placement in an enterprise
- participation in a New Apprenticeship (traineeship) arrangement
- use of a Practice Firm or simulated work environment
- flexible delivery methods used by training providers to cater for distance education students
- Recognition of Prior Learning, Recognition of Current Competencies (in skill areas where there has been no significant change to work practice in recent times).

Evidence gathering methods may include:

- demonstration
- questioning
- workplace performance
- role-play
- simulation
- projects/assignments

- written tests
- skills portfolio
- third party reports

Underpinning  
knowledge and  
skills

Knowledge

- a firm's general and trust accounting policies, procedures and systems
- bank procedures and policies/requirements
- relevant current legislation (see Range of Variables)
- legal terminology in relation to trust accounting and the matter at hand
- procedures for authorising cheques against the trust account
- preparing cheques
- security/confidentiality/privacy
- Australian Standards Association Code of Practice and Accounting Standards
- Australian Accounting and Auditing Standards
- Australian Taxation Office regulations
- establishing a trust account
- transferring assets
- statutory charges, taxes, and other fees applicable to institutions

Skills

- literacy: follows written or verbal sequenced instructions about a complex legal matter
- numeracy: knowledge of mathematical procedures in relation to trust accounting, financial calculations and bookkeeping; interprets, compares, calculates and checks for accuracy with money in legal context
- interpersonal skills in relation to co-workers and clients
- use of accounting records system
- communication: listens to clear instructions; questions to clarify information

## KEY COMPETENCIES

### Utilisation of the Key Competencies required in the performance of this unit

Communicating ideas and information	Collecting, analysing and organising information	Planning and organising activities	Working with others in a team	Using mathematical ideas and techniques	Solving problems	Using technology
1	3	1	2	2	2	2

### Performance Levels:

Level 1	Level 2	Level 3
<ul style="list-style-type: none"> <li>carries out established processes</li> <li>makes judgements of quality using given criteria</li> </ul>	<ul style="list-style-type: none"> <li>manages processes</li> <li>selects the criteria for the evaluation process</li> </ul>	<ul style="list-style-type: none"> <li>establishes principles and processes</li> <li>evaluates and reshapes processes</li> <li>establishes criteria for evaluation of processes</li> </ul>

## Modification History

Not Available

## INTRODUCTION

**Unit Descriptor** This unit covers design and development of business documents using complex technical features of word processing and/or desktop publishing software.

This unit is related to BSBADM304A Design and develop text documents and BSBADM506A Manage business document design and development.

Competency      Business Administration Services  
Field

## Element

## Performance Criteria

- |                                  |  |
|----------------------------------|--|
| 1. Use safe work practices       | 1.1 Workspace, furniture and equipment are adjusted to suit the ergonomic requirements of the user<br>1.2 Work organisation meets organisational and statutory requirements for computer operation<br>1.3 Energy and resource conservation techniques are used to minimise wastage in accordance with organisational and statutory requirements  |
| 2. Analyse document requirements | 2.1 Organisational and task requirements are identified prior to document design<br>2.2 Complex technical functions of the software are evaluated for their usefulness in fulfilling the requirements of the task<br>2.3 Document requirements are matched with software functions to provide efficient production of documents  |
| 3. Design complex documents      | 3.1 Document structure and layout are designed to suit the purpose, audience and information requirements of the task<br>3.2 Document is designed to enhance readability and appearance and meet organisational and task requirements for style and layout<br>3.3 Complex software functions are used to enable efficient manipulation of information and other material and ensure consistency of design and layout<br>3.4 Manuals, user documentation and on-line help are used to overcome problems with document design and production |
| 4. Produce documents             | 4.1 Complex operations used in development of documents achieve required results<br>4.2 Documents are previewed, adjusted and printed in accordance with organisational and task requirements<br>4.3 Documents are named and stored, in accordance with organisational requirements and the application exited without information loss/damage.<br>4.4 Documents are prepared within designated timelines and organisational requirements for speed and accuracy.  |

## RANGE STATEMENT

The Range Statement provides advice to interpret the scope and context of this unit of competency, allowing for differences between enterprises and workplaces. It relates to the unit as a whole and facilitates holistic assessment. The following variables may be present for this particular unit:

Legislation, codes and national standards relevant to the workplace which may include:	<ul style="list-style-type: none"><li>• award and enterprise agreements and relevant industrial instruments</li><li>• relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination</li><li>• relevant industry codes of practice</li></ul>
Complex documents may include:	<ul style="list-style-type: none"><li>• long documents</li><li>• multiple sections</li><li>• multiple headers and footers</li><li>• different odd and even pages</li><li>• master documents</li><li>• subdocuments</li><li>• primary mail merge documents</li><li>• mail merge data documents</li><li>• templates</li><li>• multiple users</li><li>• hyperlinks</li><li>• concordance files</li><li>• document protection</li><li>• linked and/or embedded objects</li><li>• captions</li><li>• call outs</li><li>• drawing</li><li>• WordArt</li><li>• forms with fields</li></ul>
Software may include:	<ul style="list-style-type: none"><li>• wordprocessing</li><li>• advanced desktop publishing</li></ul>
Organisational policy and	<ul style="list-style-type: none"><li>• log-on procedures</li></ul>

procedures may include:

- password protection
- storage / location of data
- standard formats
- author's instructions
- use of templates

Ergonomic requirements may include:

- workstation height and layout
- chair height, seat and back adjustment
- footrest
- screen position
- keyboard and mouse position
- document holder
- posture
- avoiding radiation from computer screens
- lighting
- noise minimisation

Work organisation may include:

- mix of repetitive and other activities
- rest periods
- exercise breaks

Conservation techniques may include:

- double-sided paper use
- re-used paper for rough drafts (observing confidentiality requirements)
- recycling used and shredded paper
- utilising power-save options for equipment

Organisational requirements may include:

- consistent corporate image
- company logo
- company colour scheme
- established guidelines and procedures for document production
- 'house styles'
- content restrictions
- templates
- organisation name, time, date, document title, filename, etc in header / footer
- observing copyright legislation



- Complex technical functions may include:
- table of contents
  - index
  - importing
  - exporting
  - linking
  - embedding
  - merge criteria
  - fields
  - form fields
  - formulae
  - sort criteria
  - macros
  - templates
  - display features
  - data transfer

- Structure and layout may include:
- white space
  - typeface
  - graphics
  - photographs
  - drawing
  - boxes
  - colour
  - page layout
  - headings
  - columns
  - letter and memo conventions

- Design choices may include:
- simplicity
  - diversity
  - balance
  - typography
  - text flow
  - relative positioning of graphics and headings

- Consistency of design and layout may include:
- indentations
  - spacings
  - page numbers
  - typeface styles and point size

- captions
- bullet/ number lists
- footnotes/endnotes
- annotated references
- borders
- consistency with other business documents

Printing may include:

- with drawing objects
- with comments
- with hidden text
- with field codes
- to fit specific number of pages
- print to file
- print merge
- 

Naming and storage of documents may include:

- file names which are easily identifiable in relation to the content
- file/directory names which identify the operator, author, section, date etc
- file names according to organisational procedure eg numbers rather than names
- storage in folders / sub-folders
- storage on hard/floppy disk drives, CD ROM, tape backup
- organisation policy for backing up files
- organisation policy for filing hard copies of documents
- filing locations
- security
- authorised access

Designated timelines may include:

- timeline agreed with supervisor/person requiring spreadsheet
- timeline agreed with internal/external client
- organisation timeline eg deadline requirements

## EVIDENCE GUIDE

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competence for this unit. This is an integral part of the assessment of competence and should be read in conjunction with the Range Statement.

Critical Aspects of Evidence	<ul style="list-style-type: none"><li>• Integrated demonstration of all elements of competency and their performance criteria</li><li>• Knowledge and application of complex software functions</li></ul>
Underpinning Knowledge* * At this level the learner must demonstrate understanding of a broad knowledge base incorporating some theoretical concepts.	<ul style="list-style-type: none"><li>• Relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination</li><li>• Advanced functions of wordprocessing and/or desktop publishing software applications</li><li>• Impact of formatting and design on the presentation and readability of documents</li><li>• Organisational policies and procedures</li></ul>
Underpinning Skills	<ul style="list-style-type: none"><li>• Literacy skills to interpret and evaluate the purposes and objectives of various types of software; consider aspects of context, purpose and audience when generating and formatting texts; display logical organisation of written information through the use of coherently linked paragraphs; use a variety of strategies for planning and reviewing own work; demonstrate drafting techniques; use simple and complex syntactic structures; select vocabulary to create nuances of meaning in particular contexts</li><li>• Proofreading and editing skills to ensure clarity of meaning and conformity to organisational requirements; check for accuracy and consistency of information by consulting additional resources</li><li>• Problem solving skills to use processes flexibly and interchangeably</li><li>• Numeracy skills to collate and present data; graphs and annotated references</li><li>• Communication skills to follow complex oral instructions when using technology; listen to and interpret complex sequenced instructions</li><li>• Keyboarding skills</li><li>• Ability to relate to people from a range of social, cultural</li></ul>

and ethnic backgrounds and physical and mental abilities

#### Resource Implications

- The learner and trainer should have access to appropriate documentation and resources normally used in the workplace which may include:
- Workplace references such as computer user manuals, organisational policies and procedures and workplace procedural manuals
- Computer equipment including relevant software, printer
- Guide/examples of 'house style'
- Equipment (eg paper and other materials)

#### Consistency of Performance

- In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range and variety of situations

#### Context/s of Assessment

- Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement
- Assessment must take account of the endorsed assessment guidelines in the Business Services Training Package
- Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment
- Assessment should reinforce the integration of the key competencies and the business services common competencies for the particular AQF level. Refer to the Key Competency Levels at the end of this unit

## KEY COMPETENCY LEVELS

NB: These levels do not relate to the Australian Qualifications Framework. They relate to the seven areas of generic competency that underpin effective workplace practices.

Collect, analyse and organise	Communicate ideas and	Plan and organise	Work with others	Use mathematical ideas and	Solve problems	Use technology
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information	information	activities	and in teams	techniques		
Level 2	Level 1	Level 1	Level 1	Level 1	Level 2	Level 2

**Three levels of performance denote level of competency required to perform a task.**

### **1. Perform 2. Administer 3. Design**

- Collecting, analysing and organising information – to determine document requirements
- Communicating ideas and information – through well-designed business documents
- Planning and organising activities – to meet designated timelines
- Working with teams and others – to determine document purpose and audience
- Using mathematical ideas and techniques – to determine design requirements
- Solving problems – using manuals and on-line help
- Using technology – to produce complex business documents

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

## BSBADM408A Prepare financial reports

### Modification History

Not applicable.

### Unit Descriptor

This unit covers recording general journal adjustment entries and preparing end-of-period financial reports such as revenue statements and balance sheets for a non-reporting entity.

This unit is related to BSBADM310A Maintain a general ledger.

This unit covers recording general journal adjustment entries and preparing end-of-period financial reports such as revenue statements and balance sheets for a non-reporting entity.

This unit is related to BSBADM310A Maintain a general ledger.

### Application of the Unit

Not applicable.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

Not applicable.

### Elements and Performance Criteria Pre-Content

Not applicable.

### Elements and Performance Criteria

#### Elements and Performance Criteria

Element	Performance Criteria
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- 1 Maintain asset register
  - 1.1 A register of property, plant and equipment is prepared from fixed asset transactions in accordance with organisational policy and procedures
  - 1.2 Method of calculating depreciation is determined in accordance with organisational requirements
  - 1.3 Asset register and associated depreciation schedule are maintained in accordance with organisational policy and procedures and accounting requirements
- 2 Record general journal entries for balance day adjustments
  - 2.1 Depreciation of non-current assets and disposal of fixed assets are recorded in accordance with organisational policy and procedures
  - 2.2 Expense and revenue accounts are adjusted for prepayments and accruals in accordance organisational policy and procedures and accounting requirements
  - 2.3 Bad and doubtful debts are recorded in accordance with organisational policy and procedures and accounting requirements
  - 2.4 Ledger accounts are adjusted for inventories, if required, and transferred to final accounts in accordance with organisational policy and procedures and accounting requirements
- 3 Prepare final general ledger accounts
  - 3.1 General journal entries for balance day adjustments are entered in general ledger system in accordance with organisational policy and procedures and accounting requirements
  - 3.2 Revenue and expense account balances are posted to final general ledger accounts system in accordance with organisational policy and procedures and accounting requirements
  - 3.3 Final general ledger accounts are prepared to reflect gross and net profits for reporting period in accordance with organisational policy and procedures and accounting requirements
- 4 Prepare end-of-period financial reports
  - 4.1 Revenue statement is prepared in accordance with organisational requirements to reflect operating profit for reporting period

- 4.2 Balance sheet is prepared in accordance with organisational requirements to reflect financial position of business at end of reporting period
- 4.3 Errors are identified and corrected, or referred for resolution in accordance with organisational policy and procedures

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competence for this unit. This is an integral part of the assessment of competence and should be read in conjunction with the Range Statement.

### Critical Aspects of Evidence

Integrated demonstration of all elements of competency and their performance criteria

Adherence to Australian Accounting and Auditing Standards

Adherence to double-entry principles

Systematic tracing of errors

### Underpinning Knowledge

\* At this level the learner must demonstrate understanding of a broad knowledge base incorporating some theoretical concepts.

Relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

Knowledge of organisation's policies, procedures and accounting requirements

Knowledge of organisation's accounting systems

Double-entry bookkeeping principles

General journal and general ledger entries

### Underpinning Skills

Literacy skills to identify financial information, to follow Australian Accounting and Auditing Standards and the organisation's accounting procedures

Communication skills including questioning, clarifying, reporting

Numeracy skills in relation to calculation of percentages, simple addition and subtraction



Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

### **Resource Implications**

The learner and trainer should have access to appropriate documentation and resources normally used in the workplace which may include:

Australian Accounting and Auditing Standards

Organisational accounting procedures

### **Consistency of Performance**

In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range and variety of situations

### **Context/s of Assessment**

Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement

Assessment must take account of the endorsed assessment guidelines in the Business Services Training Package

Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment

Assessment should reinforce the integration of the key competencies and the business services common competencies for the particular AQF level. Refer to the Key Competency Levels at the end of this unit

### **Key Competency Levels**

**Collecting, analysing and organising information** (Level 2)- to prepare an asset register

**Communicating ideas and information** (Level 1)- through revenue statements and balance sheets

**Planning and organising activities** (Level 1)- to prepare end-of-period financial reports

**Working with teams and others** (Level 1)- to correct or refer errors for resolution

**Using mathematical ideas and techniques** (Level 2)- to calculate depreciation

**Solving problems** (Level 2)- to ensure accounts balance

**Using technology** (Level 2)- to prepare or generate financial reports as required

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competence for this unit. This is an integral part of the assessment of competence and should be read in conjunction with the Range Statement.

### **Critical Aspects of Evidence**

Integrated demonstration of all elements of competency and their performance criteria

Adherence to Australian Accounting and Auditing Standards

Adherence to double-entry principles

Systematic tracing of errors

### **Underpinning Knowledge**

\* At this level the learner must demonstrate understanding of a broad knowledge base incorporating some theoretical concepts.

Relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

Knowledge of organisation's policies, procedures and accounting requirements

Knowledge of organisation's accounting systems

Double-entry bookkeeping principles

General journal and general ledger entries

### **Underpinning Skills**

Literacy skills to identify financial information, to follow Australian Accounting and Auditing Standards and the organisation's accounting procedures

Communication skills including questioning, clarifying, reporting

Numeracy skills in relation to calculation of percentages, simple addition and subtraction

Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

### **Resource Implications**

The learner and trainer should have access to appropriate documentation and resources normally used in the workplace which may include:

Australian Accounting and Auditing Standards

Organisational accounting procedures

### **Consistency of Performance**

In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range and variety of situations

### **Context/s of Assessment**

Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement

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Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment

Assessment should reinforce the integration of the key competencies and the business services common competencies for the particular AQF level. Refer to the Key Competency Levels at the end of this unit

### **Key Competency Levels**

**Collecting, analysing and organising information** (Level 2)- to prepare an asset register

**Communicating ideas and information** (Level 1)- through revenue statements and balance sheets

**Planning and organising activities** (Level 1)- to prepare end-of-period financial reports

**Working with teams and others** (Level 1)- to correct or refer errors for resolution

**Using mathematical ideas and techniques** (Level 2)- to calculate depreciation

**Solving problems** (Level 2)- to ensure accounts balance

**Using technology** (Level 2)- to prepare or generate financial reports as required

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

### **Range Statement**

The Range Statement provides advice to interpret the scope and context of this unit of competence, allowing for differences between enterprises and workplaces. It relates to the unit as a whole and facilitates holistic assessment. The following variables may be present for this particular unit:

#### **Legislation, codes and national standards relevant to the workplace which may include:**

award and enterprise agreements and relevant industrial instruments

relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

relevant industry codes of practice

#### **Calculation of depreciation may include:**

straight-line method

reducing balance method

#### **Expense accounts may include:**

rent paid

insurance

rates

wages and salaries

freight inward/outward

interest paid

distribution expenses

electricity

telephone/fax

**Revenue accounts may include:**

interest received

commission received

rent received

**Prepayments and accruals may include:**

prepaid expenses

prepaid revenue

accrued expenses

accrued revenue

**Bad and doubtful debts may include:**

writing off bad debts against provision for doubtful debts

calculation of provision for doubtful debts

**Inventories may include:**

goods for resale

stationery/office supplies

**Final accounts may include:**

Trading

profit and loss

**Revenue statement comprises:**

cost of goods sold if applicable

unclassified adjusted expenses and revenue

gross profit

operating net profit

**Reporting period may include:**

financial year

as determined in organisational procedures

**Balance sheet comprises:**

narrative or T format

unclassified assets and liabilities

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insurance

rates

wages and salaries

freight inward/outward

interest paid

distribution expenses

electricity

telephone/fax

**Revenue accounts may include:**

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prepaid revenue

accrued expenses

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**Inventories may include:**

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stationery/office supplies

**Final accounts may include:**

Trading

profit and loss

**Revenue statement comprises:**

cost of goods sold if applicable

unclassified adjusted expenses and revenue

gross profit

operating net profit

**Reporting period may include:**

financial year

as determined in organisational procedures

**Balance sheet comprises:**

narrative or T format

unclassified assets and liabilities

**Unit Sector(s)**

Not applicable.

## BSBCMM401A Make a presentation

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit covers the performance outcomes, skills and knowledge required to prepare, deliver and review a presentation to a target audience.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who may be expected to make presentations for a range of purposes, such as marketing, training, promotions, etc. They contribute well developed communication skills in presenting a range of concepts and ideas.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Prepare a presentation	<p>1.1. Plan and document presentation approach and intended outcomes</p> <p>1.2. Choose <b><i>presentation strategies, format and delivery methods</i></b> that match the <b><i>characteristics</i></b> of the target audience, location, resources and personnel needed</p> <p>1.3. Select <b><i>presentation aids, materials and techniques</i></b> that suit the format and purpose of the presentation, and will enhance audience understanding of key concepts and central ideas</p> <p>1.4. Brief others involved in the presentation on their roles/responsibilities within the presentation</p> <p>1.5. Select <b><i>techniques to evaluate presentation effectiveness</i></b></p>
2. Deliver a presentation	<p>2.1. Explain and discuss desired outcomes of the presentation with the target audience</p> <p>2.2. Use presentation aids, materials and examples to support target audience understanding of key concepts and central ideas</p> <p>2.3. Monitor non-verbal and verbal communication of participants to promote attainment of presentation outcomes</p> <p>2.4. Use persuasive communication techniques to secure audience interest</p> <p>2.5. Provide opportunities for participants to seek</p>



ELEMENT	PERFORMANCE CRITERIA
	<p>clarification on central ideas and concepts, and adjust the presentation to meet participant needs and preferences</p> <p>2.6. Summarise key concepts and ideas at strategic points to facilitate participant understanding</p>
3. Review the presentation	<p>3.1. Implement <i>techniques to review the effectiveness</i> of the presentation</p> <p>3.2. Seek and discuss reactions to the presentation from participants or from key personnel involved in the presentation</p> <p>3.3. Utilise feedback from the audience or from key personnel involved in the presentation to make changes to central ideas presented</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- culturally appropriate communication skills to relate to people from diverse backgrounds and people with diverse abilities
- facilitation and presentation skills to communicate central ideas of a message in an informative and engaging manner, and to utilise verbal and non-verbal techniques to sustain participant engagement
- literacy skills to prepare presentation information and to write in a range of styles for different target audiences.

#### Required knowledge

- data collection methods that will support review of presentations
- industry, product/service
- key provisions of relevant legislation from all forms of government that may affect aspects of business operations, such as:
  - anti-discrimination legislation
  - ethical principles
  - codes of practice
  - privacy laws
  - environmental issues
  - occupational health and safety

**REQUIRED SKILLS AND KNOWLEDGE**

- principles of effective communication
- range of presentation aids and materials available to support presentations.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- preparation, delivery and evaluation of the effectiveness of at least two presentations related to the candidate's occupation or area of interest
- knowledge of the principles of effective communication.

**Context of and specific resources for assessment**

Assessment must ensure:

- access to an actual workplace or simulated environment
- access to office equipment, documentation and resources.

**Method of assessment**

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- demonstration of preparation, delivery and evaluation of a presentation
- direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate
- observation of presentations
- review of selected presentation aids, materials and techniques
- review of briefing provided for others involved in the presentation
- evaluation of techniques implemented to review the effectiveness of the presentation.

**Guidance information for**

Holistic assessment with other units relevant to the

**EVIDENCE GUIDE****assessment**

industry sector, workplace and job role is recommended, for example:

- other general administration units.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Presentation strategies*** may involve:

- case studies
- demonstration
- discussion
- group and/or pair work
- oral presentations
- questioning
- simulations and role-play

***Presentation format and delivery methods*** may include:

- advertising copy
- audio
- direct marketing copy
- individual presentation
- public relations copy
- scripts
- storyboards
- team presentation
- verbal presentation
- video
- visuals

***Characteristics*** may include:

- age
- cultural and language background
- educational background or general knowledge
- gender
- language, literacy and numeracy needs
- physical ability
- previous experience with the topic

<b>RANGE STATEMENT</b>	
<b><i>Presentation aids and materials</i></b> may include:	<ul style="list-style-type: none"> <li>• computer simulations and presentations</li> <li>• diagrams, charts and posters</li> <li>• models</li> <li>• overhead projector</li> <li>• paper-based materials</li> <li>• video and audio recordings</li> <li>• whiteboard</li> </ul>
<b><i>Presentation techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• animation</li> <li>• comparative advertising</li> <li>• live action</li> <li>• music</li> <li>• signature elements such as:               <ul style="list-style-type: none"> <li>• slogans</li> <li>• logotypes</li> <li>• packaging</li> </ul> </li> <li>• sound effects</li> <li>• use of a guest speaker</li> <li>• use of black and white</li> <li>• use of colour</li> <li>• use of humour</li> </ul>
<b><i>Techniques to evaluate presentation effectiveness</i></b> may include:	<ul style="list-style-type: none"> <li>• action research</li> <li>• critical friends</li> <li>• focus group interviews</li> <li>• one-on-one interviews with participants and other personnel involved in the presentation</li> <li>• written feedback provided by participants</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Communication - Interpersonal Communication
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## Co-requisite units

Co-requisite units		

## **BSBCM406A Maintain business technology**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This unit covers the skills and knowledge required to maintain the effectiveness of business technology in the workplace. It includes activities such as the maintenance of existing technology and the planning of future technology requirements.

This unit is related to BSBCM307A Maintain business resources. Consider co-assessment with BSBCM407A Coordinate business resources.

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This unit is related to BSBCM307A Maintain business resources. Consider co-assessment with BSBCM407A Coordinate business resources.

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Maintain performance of hardware and software	<ul style="list-style-type: none"><li>1.1 Systems effectiveness is monitored and evaluated to ensure it meets organisational and system requirements</li><li>1.2 Operating system, drive and disk structure, reports and files are used to identify performance problems</li><li>1.3 Disk drives and peripherals are maintained according to manufacturers' and organisational requirements</li><li>1.4 Consumables are replaced in accordance with the manufacturers' and organisational requirements</li><li>1.5 Software applications are installed and operated in accordance with developers' and organisational requirements</li></ul>
2 Provide basic system administration	<ul style="list-style-type: none"><li>2.1 System back up procedure is carried out at regular intervals according to organisational and system requirements</li><li>2.2 Security access procedures are maintained in line with organisational requirements</li><li>2.3 Licence for use of software is used, checked and recorded in accordance with organisational requirements</li><li>2.4 Virus systems are maintained and updated on a regular basis in accordance with organisational requirements</li></ul>
3 Identify future technology requirements	<ul style="list-style-type: none"><li>3.1 Sources of information about new technology are accessed to maintain knowledge in current technology</li><li>3.2 Feedback from clients and colleagues is used to identify and develop improved technology systems</li><li>3.3 Existing technology is assessed against newly available technology to determine future needs and priorities</li></ul>

- 3.4 New technologies are identified and selected to achieve and maintain continuous organisational development
- 3.5 Management and budget approval is obtained for new technologies identified and selected

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competency for this unit. This is an integral part of the assessment of competency and should be read in conjunction with the Range Statement.

### Critical Aspects of Evidence

Evaluating and mapping network operations

Reviewing compliance with system protocols

Installing software and hardware

Organising and accessing software, materials and consumables

Maintaining virus, backup and security systems in line with organisational requirements

Identifying new technologies which match the future needs of the organisation

### Underpinning Knowledge\*

\* At this level the learner must demonstrate understanding of a broad knowledge base incorporating some theoretical concepts.

The relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

Knowledge of the costs and benefits of technology maintenance strategies

Knowledge of organisation's operating systems, including knowledge of networks

Principles of developing a maintenance schedule for a network

Knowledge of back up and security procedures, maintenance and diagnostic procedures, licensing and installation and purchasing procedures

Understanding current industry accepted hardware and software products including knowledge of general features and capabilities

Understanding organisational business plans, goals and directions



Understanding methods and processes to prepare budget and cost analysis

Knowledge of access protocols (eg. internet, TP/TCP)

### **Underpinning Skills**

Literacy skills to interpret and evaluate the purposes and objectives of various uses of technology; display logical organisation of written information

Research and analysis skills to analyse and identify organisation's future technology requirements

Problem solving skills for common network problems

Report writing skills to organise information from a range of sources to form recommendations

Analytical skills in relation to systems administration

Diagnostic skills in relation to identifying problems or faults

Decision making skills for purchasing of new technology

Interpersonal skills for cooperating with others on system use

Presentation skills for explaining the operation of technology in a business environment

Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

### **Resource Implications**

The learner and trainer should have access to appropriate documentation and resources normally used in the workplace

### **Consistency of Performance**

In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range and variety of situations

### **Context/s of Assessment**

Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement

Assessment must take account of the endorsed assessment guidelines in the Business Services Training Package

Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment

Assessment should reinforce the integration of the key competencies and the Business Services Common Competencies for the particular AQF Level. Refer to the Key Competency Levels at the end of this unit

### **Key Competency Levels**

**Collecting, analysing and organising information** - (Level 3) to formulate recommendations

**Communicating ideas and information** - (Level 2) with members of the work team

**Planning and organising activities** - (Level 2) to maintain business technology

**Working with teams and others** -(Level 2) in completing scheduled tasks

**Using mathematical ideas and techniques** -(Level 2) as an aid to measure and schedule tasks

**Solving problems** - (Level 2) to identify future technology requirements

**Using technology** -(Level 3) to complete allocated tasks

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competency for this unit. This is an integral part of the assessment of competency and should be read in conjunction with the Range Statement.

### **Critical Aspects of Evidence**

Evaluating and mapping network operations

Reviewing compliance with system protocols

Installing software and hardware

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Presentation skills for explaining the operation of technology in a business environment

Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

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### **Key Competency Levels**

**Collecting, analysing and organising information** - (Level 3) to formulate recommendations

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**Planning and organising activities** - (Level 2) to maintain business technology

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**Using mathematical ideas and techniques** - (Level 2) as an aid to measure and schedule tasks

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**Using technology** - (Level 3) to complete allocated tasks

## Range Statement

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award and enterprise agreements and relevant industrial instruments

relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

relevant industry codes of practice

### **Organisational and system requirements may include:**

quality assurances and/or procedures manuals

back up procedures

security and confidentiality procedures

legal and organisational policy/guidelines and requirements

storage retrieval and type of product licenses

storage of information technology documentation

register of licenses

Occupational Health and Safety policies, procedures and programs

code of conduct

ethical standards

maintenance of customised software

updating of virus protection systems

### **Disk drives and peripherals maintenance may include:**

creating more free space on the hard disk

reviewing programs

deleting unwanted files

cleaning dust from internal and external surfaces

backing up files before major maintenance

checking hard drive for errors

defragmenting the hard disk

using up-to-date anti-virus programs

**Consumables may include:**

printer ribbons and cartridges

print heads

disks

magnetic tape and cassettes

print media

**Software may include:**

word processing applications

spreadsheet applications

accounting applications

database applications

presentation applications

internet/intranet/extranet related programs

**Information sources on new technology may include:**

industry associations

seminars, workshops and training sessions

the internet

computer magazines and journals

trade fairs

computer software designers

computer hardware manufacturers

internal/external clients

retail outlets

**Technology may include:**

computers

modems

software

client services

data transfer devices

scanners

photocopiers

printers

**Improved technology systems may include:**

access protocols  
cable data transmissions  
delivery and installation systems  
maintenance options  
multi-media  
networking options  
resource usage monitoring

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**Legislation, codes and national standards relevant to the workplace which may include:**

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**Consumables may include:**

printer ribbons and cartridges

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**Technology may include:**

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client services

data transfer devices

scanners

photocopiers

printers

**Improved technology systems may include:**

access protocols

cable data transmissions

delivery and installation systems

maintenance options

multi-media

networking options

resource usage monitoring

**Unit Sector(s)**

Not applicable.

**Modification History**

Not Available

**INTRODUCTION**

Unit Descriptor	This unit covers the reporting of financial activity for business both in response to client requests and to meet statutory requirements such as the completion of statutory requirement reports.
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This unit is related to BSBCM308A Maintain financial records.

Competency Field	Common
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**Element**

**Performance Criteria**

- |   |   |
|---|---|
| 1. Compile financial information and data | 1.1 Current financial data is collected, evaluated and coded to ensure consistency, quality and accuracy in accordance with organisational requirements<br>1.2 Conversion and consolidation procedures are used to compile analysis in accordance with organisational |
|---|---|



- |   |   |
|---|---|
|   | requirements  |
|   | 1.3 Asset and liability valuations are made, recorded and disclosed in accordance with organisational requirements                              |
|   | 1.4 Discrepancies, unusual features or queries are identified, resolved or referred to the appropriate authority                                |
| 2. Prepare statutory requirement reports      | 2.1 Income and expenditure is correctly recorded to ensure compliance with statutory requirements   |
|   | 2.2 Liabilities for tax are calculated in accordance with current legislation and revenue gathering practices                                   |
|   | 2.3 Relevant receipts, revenue documentation and payments are identified correctly  |
|   | 2.4 Statements and claims take full advantage of available benefits and allowances in accordance with statutory requirements                    |
|   | 2.5 Statutory requirement reports are submitted to appropriate authorities within stated deadlines  |
| 3. Provide financial business recommendations | 3.1 Recommendations are logically derived and supported by evidence in report   |
|   | 3.2 Recommendations propose constructive actions to enhance the effectiveness and efficacy of functions and services                            |
|   | 3.3 Recommendations are concise and facilitate direction and control of organisation's operations   |
|   | 3.4 Significant issues in statements including comparative financial performances are identified and prioritised for review and decision-making |

## RANGE STATEMENT

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- |  |  |
|--|--|
| Legislation, codes and national standards relevant to the workplace which may include: | <ul style="list-style-type: none"> <li>• award and enterprise agreements and relevant industrial instruments</li> <li>• relevant legislation from all levels of government that affects business operation, especially in regard to</li> </ul> |
|--|--|

Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

- relevant industry codes of practice

Financial data may include:

- budgets and forecasts
- financial/operational statements and reports (eg. expenditures and receipts, profit and loss statements)
- market valuations
- budget variances
- cash flow/profit reports
- Australian Bureau of Statistics (ABS) economic data
- financial markets monitoring services (eg. Reuters)

Organisational requirements may include:

- quality assurances and/or procedures manuals
- price and exchange parameters
- reporting requirements
- legal and organisational policy/guidelines and requirements
- financial analysis assessments
- Occupational Health and Safety policies, procedures and programs
- recording and filing systems
- standard financial analysis techniques
- financial management manuals

Conversion and consolidation procedures may include:

- spreadsheets
- standardised variables
- moving averages
- unit costs
- trend analysis

Discrepancies may include:

- expenditure report mismatches
- incorrect payments
- absence of auditable trail
- inappropriate authorisations
- variances from budget and phasings
- unreconciled cash flows and operating statements
- incorrect report formats

Statutory requirements may include:

- reporting periods
- taxation payment timings
- delegated authorities
- internal control procedures

Revenue gathering practices may include:

- sales
- leasing
- investments
- billing schedules
- lending and financing
- fees and charges

Revenue documentation may include:

- invoices
- declarations
- bills
- sales proceeds
- cash received
- debit notes

Available benefits and allowances may include:

- depreciation
- donations
- sales tax deductions
- interest payments

Stated deadlines may include:

- monthly returns
- annual reports
- lodgement dates
- payment schedules

Recommendations may relate to:

- profit
- loss
- expenses
- consolidation
- write-offs
- cash flow

Evidence may include:

- budgetary analysis
- forecasts and estimates

- returns on investments
- order and supplier documentation
- taxation and statutory returns

Significant issues may include:

- profitability
- losses and returns
- cost structures
- suppliers
- internal controls
- statutory obligations

Format of reports may include:

- cash flow statements
- statutory forms
- financial year reports
- balance sheets
- operating statements
- spreadsheets
- electronic forms

## EVIDENCE GUIDE

The Evidence Guide identifies the critical aspects, underpinning knowledge and skills to be demonstrated to confirm competency for this unit. This is an integral part of the assessment of competency and should be read in conjunction with the Range Statement.

Critical Aspects of Evidence	<ul style="list-style-type: none"><li>• Organising financial data to highlight relevant features</li><li>• Presenting of information in comprehensive formats</li><li>• Completing of Business Activity Statements</li><li>• Interpreting and identifying applications of statutory requirements</li><li>• Referring discrepancies outside scope of own responsibility to the appropriate persons</li></ul>
Underpinning Knowledge*	<ul style="list-style-type: none"><li>• The relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and</li></ul>

\* At this level the learner must demonstrate understanding of a broad knowledge base incorporating some theoretical concepts.

anti-discrimination

- Knowledge of organisational policies and procedures relating to maintaining financial data, reporting, preparing statutory returns
- Principles of double entry bookkeeping and accrual accounting
- Knowledge of techniques for forecasting and analysis
- Understanding methods to present financial data
- Knowledge of State and Federal Government taxes and charges
- Knowledge of financial legislation
- Knowledge of options, methods and practices for deductions, benefits and depreciations
- Principles and practices for auditing and reporting

#### Underpinning Skills

- Literacy skills to identify financial information, to follow Australian Accounting and Auditing Standards and the organisation's accounting procedures
- Research skills to analyse the organisations financial and business status
- Proof reading skills to check accuracy and consistency of information by consulting additional resources
- Problem solving skills for a defined range of predictable problems
- Report writing skills to assess information for relevance and accuracy from a range of sources
- Decision making skills in a limited range of options
- Numeracy skills for calculating data, reconciling figures
- Planning skills for timetabling and scheduling reports and lodgements
- Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

#### Resource Implications

The learner and trainer should have access to appropriate documentation and resources normally used in the workplace

#### Consistency of Performance

In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range

and variety of situations

#### Context/s of Assessment

- Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement
- Assessment must take account of the endorsed assessment guidelines in the Business Services Training Package
- Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment
- Assessment should reinforce the integration of the key competencies and the Business Services Common Competencies for the particular AQF Level. Refer to the Key Competency Levels at the end of this unit

## KEY COMPETENCY LEVELS

NB: These levels do not relate to the Australian Qualifications Framework. They relate to the seven areas of generic competency that underpin effective workplace practices.

Collect, analyse and organise information	Communicate ideas and information	Plan and organise activities	Work with others and in teams	Use mathematical ideas and techniques	Solve problems	Use technology
Level 3	Level 2	Level 2	Level 2	Level 3	Level 2	Level 2

**Three levels of performance denote level of competency required to perform a task.**

1. Perform    2. Administer    3. Design

- Collecting, analysing and organising information – to forecast and provide recommendations
- Communicating ideas and information – with members of the work team

- Planning and organising activities – for completion of statutory returns and reports
- Working with teams and others – in completing scheduled tasks
- Using mathematical ideas and techniques – in reconciling financial documents
- Solving problems – to identify discrepancies and errors
- Using technology – to complete allocated tasks

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

## BSBCRT401A Articulate, present and debate ideas

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to articulate, present and debate ideas.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who need to present and debate ideas in a work or broader life context.</p> <p>While the unit shares some similarities with units such as BSBCMM401A Make a presentation or BSBRES401A Analyse and present research information, the focus is quite different.</p> <p>This unit focuses on the creative ways in which ideas can be presented to provoke response, reaction and critical debate. Risk taking, storytelling and participation in critical debate are key features of the unit. Ideas might be quite complex in nature and relate to new products, services, creative works or new ways of doing things.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Analyse ideas for communication to others	1.1. Distil <b><i>key themes, messages and positions</i></b> to aid in clarity of thought and presentation 1.2. Reflect on <b><i>different ways of communicating ideas</i></b> for different purposes and to different people 1.3. Identify the enabling skills and attributes of <b><i>individuals</i></b> who can effectively participate in discussions about ideas
2. Provoke response and reaction	2.1. Explore and use <b><i>different techniques to engage, fascinate and involve others</i></b> in the process of communication and exchange 2.2. Explore the ways that storytelling can be used to communicate ideas 2.3. Create <b><i>innovative approaches to different communication challenges</i></b> 2.4. Be prepared to take <b><i>risks</i></b> in the way ideas are

ELEMENT	PERFORMANCE CRITERIA
	presented 2.5. Identify <i>specific ways to provoke and encourage response</i> in particular individuals or groups
3. Debate and discuss ideas	3.1. Present and argue <i>substantiated positions</i> on ideas 3.2. Be open to critical analysis of own ideas and to the ideas of others 3.3. Identify and participate in conversations that challenge and explore different concepts and approaches, and generate new ideas 3.4. Respond to questions about ideas with confidence and relevant information 3.5. Reflect on and appraise the views of others, and use to refine ideas and to embrace new ideas

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to present ideas in ways that engage and provoke response, and to debate and discuss potentially complex concepts
- creative thinking skills to develop responses and new ideas in response to feedback
- learning and self-management skills to actively seek feedback and to learn from others
- literacy skills to develop and interpret information dealing with complex ideas.

#### Required knowledge

- creative and different ways of expressing and communicating ideas, and of making an opportunity pitch
- different ways in which individuals receive and respond to ideas and information, and what influences their response
- nature and role of risk taking in the presentation and debate of ideas
- role of storytelling in communicating ideas and key storytelling techniques
- techniques to tailor comments to particular audiences.

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• creative and articulate presentations that provoke interest and response</li> <li>• active and confident participation in critical debate and discussion of ideas.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• presentations to others about ideas</li> <li>• discussion and debate with others about ideas.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• direct observation of candidate participation in presentations and debates</li> <li>• evaluation of candidate's skills in responding to new and different communication situations</li> <li>• evaluation of candidate telling a story, making a pitch or presenting ideas to complete strangers in 'different' environments (e.g. in a restaurant, in the corridor, on a bus, in a lift).</li> </ul>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating

<b>RANGE STATEMENT</b>	
conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b><i>Key themes, messages and positions</i></b> may relate to:	<ul style="list-style-type: none"> <li>• essence of the idea</li> <li>• influences on the idea</li> <li>• relationship of idea to established tradition or practice</li> <li>• relationship of idea to new and emerging technology</li> <li>• problems and challenges with the idea</li> <li>• reasons why the idea should be supported</li> <li>• selling a creative team</li> <li>• selling creative ideas</li> <li>• selling self as a creative person</li> <li>• way the idea was developed</li> <li>• who had developed the idea and why</li> </ul>
<b><i>Different ways of communicating ideas</i></b> may be:	<ul style="list-style-type: none"> <li>• aural</li> <li>• group presentation/pitch</li> <li>• in a forum</li> <li>• in elevators</li> <li>• one-on-one discussion</li> <li>• on planes</li> <li>• oral</li> <li>• remote (e.g. video conferencing)</li> <li>• visual</li> </ul>
<b><i>Individuals</i></b> may be:	<ul style="list-style-type: none"> <li>• colleagues</li> <li>• community members</li> <li>• friends</li> <li>• gallery owners</li> <li>• interviewers (media)</li> <li>• investors</li> <li>• mentors</li> <li>• panels</li> <li>• peers</li> <li>• students</li> <li>• supervisors or managers</li> </ul>
<b><i>Different techniques to engage, fascinate and involve others</i></b> may include:	<ul style="list-style-type: none"> <li>• blogging</li> <li>• media releases</li> <li>• multimedia presentations</li> <li>• music</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• photography</li> <li>• storytelling</li> <li>• viral marketing</li> <li>• visual depictions</li> </ul>
<i>Innovative approaches to communication challenges</i> may involve ability to:	<ul style="list-style-type: none"> <li>• get across all key messages in a short time</li> <li>• present on unfamiliar topic</li> <li>• respond to impromptu situations</li> <li>• structure information quickly and effectively</li> </ul>
<i>Specific ways to provoke and encourage response</i> may include:	<ul style="list-style-type: none"> <li>• use of engaging objects to explain idea</li> </ul>
<i>Risks</i> may involve:	<ul style="list-style-type: none"> <li>• acknowledging own limits and difficulties</li> <li>• asking for help</li> <li>• breaking out of accepted norms</li> <li>• divulging personal information or vulnerabilities</li> <li>• failing and learning from it</li> <li>• incorporating humour</li> <li>• taking a fun approach with a potentially serious audience</li> </ul>
<i>Substantiated positions</i> may be positions which are:	<ul style="list-style-type: none"> <li>• grounded in appropriate research</li> <li>• result of rational and logical thought</li> <li>• subjected to the analysis of others (e.g. peer review)</li> <li>• supported by relevant information</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Creativity and Innovation - Creative Thinking
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## Co-requisite units

Co-requisite units		

## BSBCRT402A Collaborate in a creative process

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to collaborate in a creative process.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who participate in a collaborative creative process in a work or broader life context. It is relevant to individuals who are involved in what is traditionally considered creative endeavour but is also very important in broader business and community activities where creative team effort is highly valued.</p> <p>The unit focuses on effective engagement in a collaborative process, underpinned by a commitment to trust and ethics as a key feature of collaborative creative effort.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Enter into a collaborative creative process	<p>1.1. Adopt a <b><i>personal philosophy of trustworthy and ethical behaviour</i></b></p> <p>1.2. Maximise the possibilities of sustaining creative partnerships through trustworthy and ethical behaviour</p> <p>1.3. Use <b><i>professional discretion and judgement</i></b> in dealing with others</p> <p>1.4. Acknowledge and respect the <b><i>different ways that different people may contribute</i></b> to the creative process</p> <p>1.5. Acknowledge and work within the legal framework that applies to creative content as part of individual commitment to an ethical approach</p> <p>1.6. Respect collaborative efforts by relinquishing individual ownership of ideas</p>
2. Engage in a collaborative creative	2.1. Maintain a <b><i>belief in personal ideas</i></b> , combined with a willingness to move on as ideas are discarded and



ELEMENT	PERFORMANCE CRITERIA
process	<p>others evolve</p> <p>2.2.Be prepared to let go of own vanity and ego to allow new ideas to emerge</p> <p>2.3.Use <i>language</i> and adopt a <i>demeanour</i> that demonstrates respect and trust for others</p> <p>2.4.Listen to, value, respect and trust the contributions of others as material to work with rather than positions to argue against</p> <p>2.5.Challenge, test and share ideas in a supportive way as part of the creative process</p> <p>2.6.Move on from initial positions and preconceptions to accept and embrace new and unpredictable ideas as they emerge during the creative process</p> <p>2.7.Play a role that encourages the <i>movement and shift of ideas</i> within the group towards a well-conceived solution</p>
3. Reflect on own role in the collaborative creative process	<p>3.1.Reflect on own level of participation, relationships with others and personal behaviour in the collaborative process</p> <p>3.2.Identify ways to do better next time and follow up on any issues that need to be resolved</p> <p>3.3.Identify and seek opportunities to refine and expand own skills and knowledge, including learning from failing</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to nurture trust, to model open and supportive communication, and to articulate potentially complex ideas
- creative thinking skills to generate and explore ideas
- learning and self-management skills to reflect on and enhance own ability to contribute effectively to a collaborative creative process
- problem-solving skills to continually be evaluating and challenging ideas and moving them forward towards solutions.

**REQUIRED SKILLS AND KNOWLEDGE****Required knowledge**

- concept of shared intellectual property from collaborative creativity
- concepts of trust and ethical behaviour in the context of creative endeavour
- different roles people may play in a collaborative creative process and how this contributes to the overall effort
- how the creative process works in different situations (e.g. as an individual, as part of a group)
- how the potential for creativity can be maximised within a team
- legal framework that affects copyright, moral rights and intellectual property issues
- what stops creativity in a group environment.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- positive and full participation in a collaborative creative process that generates, expands and develops ideas into a well-conceived solution
- communication and creative-thinking skills that make a positive contribution to the collaborative effort
- knowledge and understanding of the ethical framework in which any type of creative endeavour operates.

**Context of and specific resources for assessment**

Assessment must ensure:

- involvement of a team of people in the collaborative creative process.

**Method of assessment**

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• direct observation of the candidate participating in collaborative creative activity</li> <li>• interviews with others participating in the process to determine the nature and quality of the candidate's participation and interactions</li> <li>• evaluation of candidate presentation (verbal or written) on the collaborative process, including challenges, benefits and key learning for the future</li> <li>• oral or written questioning to assess knowledge of concepts of trust and ethical behaviour in the context of creative endeavour.</li> </ul>
<b>Guidance information for assessment</b>	<p>A collaborative creative effort always occurs in a specific context. Therefore holistic assessment with other units relevant to the industry sector, workplace and job role is highly recommended. Assessors must, however, retain a strong focus on the key aspects of collaboration and creativity detailed in this unit. Combined assessment with the following unit would also be appropriate:</p> <ul style="list-style-type: none"> <li>• BSBCRT301A Develop and extend critical and creative thinking skills.</li> </ul>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<p><b><i>Personal philosophy of trustworthy and ethical behaviour</i></b> may relate to:</p>	<ul style="list-style-type: none"> <li>• acknowledging discomfort or anger</li> <li>• being prepared to fully participate</li> <li>• communicating in an open way</li> <li>• honesty</li> <li>• honouring commitments</li> <li>• sensitivity to social, cultural, personal situations and dynamics</li> <li>• showing respect</li> <li>• understanding of the consequences of actions</li> </ul>

<b>RANGE STATEMENT</b>	
<b><i>Professional discretion and judgement</i></b> may relate to:	<ul style="list-style-type: none"> <li>• assessing when to keep quiet</li> <li>• being aware of and responding to different personality types</li> <li>• knowing when it is appropriate or inappropriate to share information</li> <li>• knowing with whom information should be shared</li> </ul>
<b><i>Different ways that different people may contribute</i></b> may relate to:	<ul style="list-style-type: none"> <li>• different approaches to expressing opinions or ideas</li> <li>• inclinations to lead or follow</li> <li>• influence with others</li> <li>• interpersonal skills</li> <li>• networks</li> <li>• past experience</li> <li>• technical skills and expertise</li> </ul>
<b><i>Belief in personal ideas</i></b> may be demonstrated by:	<ul style="list-style-type: none"> <li>• backing ideas up with information and rationale</li> <li>• being prepared to argue for own ideas</li> <li>• confidence in own ability to create many ideas</li> <li>• confidence to share ideas</li> <li>• confident articulation of ideas</li> <li>• spending time developing and refining own ideas</li> </ul>
<b><i>Language</i></b> that demonstrates respect for others may involve:	<ul style="list-style-type: none"> <li>• acknowledging new ideas and effort</li> <li>• avoiding negative words</li> <li>• avoiding personal negatives like 'you cannot' or 'you should not'</li> <li>• choosing words wisely</li> <li>• listening</li> <li>• making differentiations between ideas and people</li> <li>• managing tone</li> <li>• speaking at a level appropriate to the listener</li> </ul>
<b><i>Demeanour</i></b> that demonstrates respect for others may relate to:	<ul style="list-style-type: none"> <li>• avoiding intellectual bullying</li> <li>• encouraging others to express ideas</li> <li>• facial expression</li> <li>• keeping a positive mindset</li> <li>• listening before speaking</li> <li>• physical position</li> <li>• refraining from blame or accusation</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• other non-verbal behaviour</li> <li>• understanding the balance between constructive comment and attention seeking</li> </ul>
<i><b>Movement and shift of ideas</b></i> may involve:	<ul style="list-style-type: none"> <li>• building in 'what if' scenarios</li> <li>• encouraging a stocktake before moving forward</li> <li>• making connections between seemingly disparate ideas</li> <li>• refining ideas that seem positive</li> <li>• returning to earlier ideas</li> <li>• returning to key objectives</li> <li>• suggesting new processes</li> <li>• turning ideas 'on their head' to resolve blockages</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Creativity and Innovation - Creative Process
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## Co-requisite units

Co-requisite units		

## BSBCRT501A Originate and develop concepts

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to originate and develop concepts for products, programs, processes or services to an operational level.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who originate and develop concepts of some complexity and progress that concept to the point where it can be implemented. Individuals may be employed by organisations, be sub contractors or consultants brought in by companies to work on specific projects, or be individuals or part of a team working independently.</p> <p>Concepts could be developed for any business or community activity or process such as marketing campaigns, staff development programs, information technology and communication systems. This unit is also highly relevant to practitioners in the creative industries who develop products such as advertising campaigns, radio and television programs, entertainment events, films, exhibitions and digital media products.</p> <p>A person undertaking this role would operate with a high degree of autonomy and at a senior level if working within an organisation. However, the process of generating concepts and ideas is collaborative in nature.</p> <p>Skills associated with writing proposals to support concept development are covered in BSBWRT401A Write complex documents.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Evaluate and explore needs and opportunities	1.1. Research and evaluate <i>existing information that informs new concept development</i> 1.2. Where appropriate, identify and use gaps in current range of <i>products, programs, processes or services</i> as the catalyst for generating new ideas or concepts 1.3. Expand the potential of new ideas through <i>exploration of opportunities beyond the obvious</i>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.4. Identify <b><i>factors</i></b> that could have an impact on ideas or concepts to be developed, including potential for commercialisation</p> <p>1.5. Determine whether other players are filling identified gaps or investigating similar opportunities</p> <p>1.6. Develop preliminary ideas on innovative and different ways to address needs and opportunities</p> <p>1.7. In consultation with <b><i>relevant stakeholders</i></b>, agree on broad parameters for developing ideas and concepts to meet market requirements</p>
2. Develop a range of creative approaches	<p>2.1. Use a range of <b><i>creative thinking techniques</i></b> to generate innovative and creative concepts to address identified needs</p> <p>2.2. Challenge, test and experiment with different concepts and ideas as part of a collaborative process</p> <p>2.3. Evaluate concepts in terms of their suitability for the target audience or purpose, their feasibility and their commercial potential</p> <p>2.4. Take account of social, ethical and environmental issues as concepts and ideas are generated and discussed</p> <p>2.5. Identify <b><i>resources</i></b> required to achieve desired creative and innovative outcomes</p> <p>2.6. Evaluate the effectiveness of different strategies for achieving desired outcomes</p> <p>2.7. Select concepts or approaches that achieve required outcomes in an innovative and feasible way</p> <p>2.8. Present proposed concepts or approaches in an appropriate <b><i>format</i></b></p>
3. Refine concepts	<p>3.1. Ensure concept development process is open to ongoing refinement and testing</p> <p>3.2. Seek input and feedback on concepts from relevant stakeholders</p> <p>3.3. Seek specialist advice on creative and technical aspects of proposals as required</p> <p>3.4. Compare concepts with best practice examples of similar products, programs, processes or services</p> <p>3.5. Use a range of <b><i>creative and practical criteria</i></b> to determine the advantages and disadvantages of different concepts</p> <p>3.6. Evaluate <b><i>constraints</i></b> on the realisation of concepts or ideas</p>



ELEMENT	PERFORMANCE CRITERIA
	3.7.Refine proposals based on analysis and feedback
4. Develop concepts to an operational level	<p>4.1.Use refined concepts as the basis for developing detailed <i>implementation specifications</i></p> <p>4.2.Present specifications to relevant parties for approval, funding or endorsement</p> <p>4.3.Reflect on methodology used to generate concepts and ideas and note ways of improving this in the future</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication and teamwork skills to work collaboratively on ideas and to articulate the rationale for concepts in ways that promote constructive discussion with others
- creative thinking skills to generate a range of innovative concepts and ideas, to use lateral thinking and to take a visionary approach to developing concepts and ideas
- initiative and enterprise skills to pro-actively identify market requirements
- planning and organising skills to take account of practical issues for concept implementation
- self-management skills to meet deadlines.

#### Required knowledge

- broad context in which concepts are being developed
- cultural, social and environmental issues and impacts to be considered in developing new concepts
- issues and requirements to commercialise the concept
- legal requirements that affect work in a given industry context
- practical and operational issues to be considered in a specific work or community context
- range of broad practical and operational issues that determine whether a concept can be implemented (in any context)
- techniques for generating creative ideas and solutions, and for translating these ideas into workable concepts.

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>development of at least two concepts, substantiated and supported with sufficient information to allow for implementation to occur</li> <li>generation of concepts and ideas that provide innovative solutions to identified issues</li> <li>knowledge of legal requirements that affect work in a given industry context.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>access to the full range of background information required to evaluate the operational factors that will affect the implementation of concepts</li> <li>interaction with others to reflect the collaborative nature of the concept development process.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>evaluation of concepts generated by the candidate, of the processes used to generate and test the ideas and the material developed to support the concept</li> <li>debate and discussion with the candidate to assess knowledge of the operational context and the broader factors that impact on concept development</li> <li>evaluation of presentation or 'pitch' made by the candidate in relation to a particular concept</li> <li>oral or written questioning to assess knowledge of cultural, social and environmental issues and impacts to be considered in developing new concepts.</li> </ul>
<b>Guidance information for assessment</b>	

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<p><b><i>Existing information that informs new concept development</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• creative brief</li> <li>• market research</li> <li>• organisational vision</li> <li>• personal vision and creative aspiration</li> </ul>
<p><b><i>Products, programs, processes or services</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• art and craft works</li> <li>• advertising campaigns</li> <li>• business services and processes</li> <li>• designs</li> <li>• festivals</li> <li>• films</li> <li>• interactive digital media products</li> <li>• live entertainment productions or events</li> <li>• manufactured products</li> <li>• marketing and promotional campaigns</li> <li>• museum and gallery exhibitions</li> <li>• photoimaging services</li> <li>• radio or television programs</li> </ul>
<p><b><i>Exploration of opportunities beyond the obvious</i></b> may involve:</p>	<ul style="list-style-type: none"> <li>• challenging existing assumptions and preconceptions</li> <li>• considering radical change to the way things are done</li> <li>• exploring practice in a totally different industry context</li> <li>• investigating the use of new media</li> <li>• making connections between seemingly unrelated activities</li> </ul>
<p><b><i>Factors</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• codes of practice</li> <li>• content</li> <li>• cost effectiveness</li> <li>• features of interactive digital media products:</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• delivery platform</li> <li>• level of interactivity</li> <li>• look and feel</li> <li>• navigation</li> <li>• Indigenous laws and protocols</li> <li>• length of program or film</li> <li>• level of skill and understanding required for implementation</li> <li>• nature and size of target audience</li> <li>• organisational charter and policies</li> <li>• purpose:               <ul style="list-style-type: none"> <li>• advertising or marketing</li> <li>• commercial</li> <li>• educational</li> <li>• entertainment</li> <li>• game</li> <li>• information</li> </ul> </li> <li>• relevant legislation, such as:               <ul style="list-style-type: none"> <li>• copyright and intellectual property</li> <li>• privacy</li> </ul> </li> <li>• results of market research</li> <li>• revenue raised by existing market share</li> <li>• technical feasibility</li> </ul>
<b><i>Relevant stakeholders</i></b> may include:	<ul style="list-style-type: none"> <li>• administrative staff</li> <li>• clients/customers</li> <li>• designers and other creative personnel</li> <li>• directors</li> <li>• external suppliers</li> <li>• information technology personnel</li> <li>• management</li> <li>• program producers</li> <li>• technical specialists</li> <li>• writers</li> </ul>
<b><i>Creative thinking techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• brainstorming:               <ul style="list-style-type: none"> <li>• bulletin board</li> <li>• buzz session</li> <li>• computer-aided</li> <li>• sequencing</li> <li>• stop and go</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Edward de Bono's six thinking hats</li> <li>• ego alter or heroes</li> <li>• graphic organisers:               <ul style="list-style-type: none"> <li>• concept fans</li> <li>• visual maps</li> <li>• webbing</li> </ul> </li> <li>• lateral thinking games</li> <li>• making associations</li> <li>• mind mapping</li> <li>• morphological analysis</li> <li>• sub-culture surfing</li> <li>• trigger words</li> <li>• use of metaphors and analogies</li> <li>• vision circles</li> <li>• word salads</li> <li>• visualisation</li> </ul>
<b>Resources</b> may include:	<ul style="list-style-type: none"> <li>• computer hardware and software</li> <li>• facilities</li> <li>• printed material</li> <li>• specialist equipment</li> <li>• specialist staff</li> <li>• training</li> </ul>
<b>Formats</b> may include:	<ul style="list-style-type: none"> <li>• application forms to funding bodies or sponsors</li> <li>• briefs for consultants</li> <li>• concept maps</li> <li>• electronic presentations to promote the concept</li> <li>• in-house proposal forms</li> </ul>
<b>Creative and practical criteria</b> may include:	<ul style="list-style-type: none"> <li>• cost-effectiveness</li> <li>• evaluation against competing priorities</li> <li>• fit with personal vision and aspirations</li> <li>• fit with strategic directions of organisation</li> <li>• fit with target market needs</li> <li>• how innovative the concept is</li> <li>• level of risk</li> <li>• potential benefits</li> <li>• technical feasibility</li> <li>• time to realise the concept</li> </ul>
<b>Constraints</b> may include:	<ul style="list-style-type: none"> <li>• availability of resources and equipment</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• availability of skilled experts and personnel</li> <li>• cost</li> <li>• level of technical difficulty</li> <li>• limited funding sources</li> <li>• limited potential for commercialisation</li> <li>• time</li> </ul>
<i>Implementation specifications</i> may include:	<ul style="list-style-type: none"> <li>• briefs for work</li> <li>• detailed specification of concept including purpose and content</li> <li>• operational plan with responsibilities and time lines</li> <li>• resources breakdown (financial, human and physical)</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Creativity and Innovation - Creative Thinking
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## Co-requisite units

Co-requisite units		

## BSBCRT601A Research and apply concepts and theories of creativity

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to undertake research into different concepts and theories of creativity, and to apply those to a particular field of endeavour.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who use sophisticated research and critical analysis skills in the exploration of creativity and its application to work and life practice. This research may be related specifically to fields of practice traditionally considered as 'creative', such as the arts, but may equally relate to much broader fields of human activity and endeavour.</p> <p>The scope of the research activity has both significant depth and breadth. A broader, more general approach to the ideas and history surrounding creativity is found in BSBCRT403A Explore the history and social impact of creativity.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research concepts and theories of creativity	1.1. Use a range of <b><i>research techniques</i></b> to source information about creativity 1.2. Identify and explore potential <b><i>new, emerging and alternative sources of ideas and thinking</i></b> about creativity 1.3. Expand own knowledge and understanding of creativity through review and <b><i>critical analysis</i></b> of information 1.4. Analyse, compare and contrast a <b><i>range of theoretical perspectives and thinking</i></b> on creativity 1.5. Identify and explore the transmigration of creative thought to innovative output
2. Apply theories of creativity to practice	2.1. Evaluate the relevance and application of different theories and practices of creativity based on analysis



ELEMENT	PERFORMANCE CRITERIA
	<p>of <i>own work and life experience</i></p> <p>2.2. Analyse the ways in which different aspects of history, theory and other influences are applied, adapted or challenged in practice</p> <p>2.3. Assess the ways in which theories, thinking and practices about creativity may be applied that provide <i>benefits to individuals, businesses and the community</i></p>
3. Develop, articulate and debate own perspectives theories and practices of creativity	<p>3.1. Take a critical approach to different theories and reflect on own ideas and responses</p> <p>3.2. Develop own <i>substantiated positions</i> in response to research and analysis</p> <p>3.3. Articulate own positions in a manner which demonstrates <i>clarity of thought and conceptual understanding</i> of different theories and thinking</p> <p>3.4. Debate own positions on creativity showing belief in own ideas and a willingness to remain open to new perspectives</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- critical thinking skills to analyse complex information and to develop and substantiate own positions and responses to theories and thinking around creativity
- communication skills to articulate and debate complex concepts
- literacy and problem solving skills to research information dealing with complex concepts and theories of creativity
- self-management skills to develop and substantiate own views and ideas.

#### Required knowledge

- different theories and concepts of creativity, including different historical perspectives and current and emerging thinking
- potential and actual benefits of creativity for individuals, businesses and communities
- relationship between theories of creativity and creativity in practice (in a particular work or broader social context).

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• conduct of at least one research project into past, current and emerging theories of creativity</li> <li>• development of substantiated positions on creativity and its application in response to own analysis and research</li> <li>• knowledge of different theories and thinking on creativity and its application in different social and work contexts.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• use of current and emerging sources of information and thinking on creativity.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• evaluation of research undertaken by the candidate into theories and application of creativity</li> <li>• observation of the candidate participating in discourse and debate on theories of creativity and on the candidate's own positions and ideas.</li> </ul>
<b>Guidance information for assessment</b>	

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b><i>Research techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• analysis of consumer trends</li> <li>• desk research</li> <li>• finding style leaders</li> <li>• informal discussions</li> <li>• internet search</li> <li>• interviews</li> <li>• literature reviews</li> <li>• observation of creative workers processes and behaviours</li> <li>• personal experience</li> <li>• tracking trendsetters</li> </ul>
<b><i>New, emerging and alternative sources of ideas and thinking</i></b> may include:	<ul style="list-style-type: none"> <li>• component resourcing</li> <li>• consumer trends</li> <li>• current business theories</li> <li>• emerging government policy</li> <li>• emerging research</li> <li>• fashion/design trends</li> <li>• grazing hardware, electronics, junk, second hand goods etc.</li> <li>• individuals in any fields of endeavour</li> <li>• innovative organisations</li> <li>• international trends</li> <li>• new products and sub assembly components</li> <li>• social trends</li> </ul>
<b><i>Critical analysis</i></b> may involve:	<ul style="list-style-type: none"> <li>• adapting</li> <li>• analysing and evaluating actions and policies</li> <li>• challenging</li> <li>• clarifying issues, values and standards</li> <li>• comparing analogous situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• critical path process</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• debate and discussion</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• ideational connecting of unrelated information</li> <li>• judging</li> <li>• leap of faith</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• obtuse connections</li> <li>• openness</li> <li>• questioning</li> <li>• reading and listening critically</li> <li>• reflecting</li> </ul>
<i>Range of theoretical perspectives and thinking</i> may be:	<ul style="list-style-type: none"> <li>• economic</li> <li>• environmental</li> <li>• geographic</li> <li>• heritage</li> <li>• historical</li> <li>• local, national, international</li> <li>• political</li> <li>• philosophical</li> <li>• social/cultural</li> <li>• style/design</li> </ul>
<i>Own work and life experience</i> may include:	<ul style="list-style-type: none"> <li>• evaluation of contexts in which creativity has flourished</li> <li>• observation of nature</li> <li>• observation of the man-made environment</li> <li>• observations of the ways people interrelate</li> <li>• reflection on own creative thinking and endeavours</li> <li>• reflection on own experience with any type of creative endeavour or creative thinking</li> <li>• workplace experience</li> </ul>
<i>Benefits to individuals, businesses and the community</i> may include:	<ul style="list-style-type: none"> <li>• adaptability</li> <li>• better individual and business relationships</li> <li>• capacity for innovation and invention</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• curiosity</li> <li>• environmentally sustainable practices</li> <li>• greater social cohesion</li> <li>• high degree of value adding</li> <li>• improved productivity and profit</li> <li>• nimbleness of thought</li> <li>• psychological wellbeing of individuals and communities</li> </ul>
<i>Substantiated positions</i> may be positions which are:	<ul style="list-style-type: none"> <li>• grounded in appropriate research</li> <li>• result of rational and logical thought</li> <li>• supported by relevant information</li> <li>• subjected to the analysis of others (e.g. peer review)</li> </ul>
<i>Clarity of thought and conceptual understanding</i> may be demonstrated by:	<ul style="list-style-type: none"> <li>• ability to exchange and debate ideas with others</li> <li>• appropriate distillation of ideas to suit the required purpose</li> <li>• audience understanding</li> <li>• clear articulation of ideas</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Creativity and Innovation - Creative Thinking
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## Co-requisite units

Co-requisite units	

<b>Co-requisite units</b>		

## BSBDES402A Interpret and respond to a design brief

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to interpret and creatively respond to a design brief through the production of work.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals working in any industry or design context where work is prescribed by a commissioning agent/client in the form of a brief. The unit is holistic in nature and focuses on the integration of the creative, communication and planning processes that support effective response to a design brief.</p> <p>In practice, this unit supports and is supported by other units describing the specialist skills and knowledge required by specific design disciplines.</p> <p>Work is carried out independently, although guidance would be available if required. Skills involving the more complex process of negotiating and refining a design brief, or managing the production process are found in BSBDES502A Establish, negotiate and refine a design brief and BSBDES601A Manage design realisation.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Interpret design brief	1.1. Correctly interpret the <i>specifications</i> of the <i>design brief</i> 1.2. Establish and clarify user or client for the proposed product/service to inform design decisions 1.3. Identify and clarify specifications, <i>parameters or constraints</i> of the design brief in consultation with relevant colleagues 1.4. Source and evaluate <i>information pertinent to design brief</i>
2. Explore and develop design concept	2.1. Generate ideas for design concept through research, exploration and experimentation 2.2. Develop initial design concept consistent with design brief parameters 2.3. Evaluate and explore options for refining the concept



ELEMENT	PERFORMANCE CRITERIA
	<p>to best meet design brief parameters</p> <p>2.4.Refine options and select the approach which best meets design brief requirements</p>
3. Liaise with client	<p>3.1.Agree on communication process and frequency of communication with the client</p> <p>3.2.Present <b>concepts for work</b> at appropriate stages during design process as required</p> <p>3.3.Present and explore different options and creative ideas with client when appropriate</p> <p>3.4.Pro-actively seek and act on client feedback</p> <p>3.5.Reach <b>agreement on concept</b> for work which complies with design brief</p>
4. Plan production of work	<p>4.1.Assess specific design production risks</p> <p>4.2.Identify all components required to produce a prototype</p> <p>4.3.Assess technical requirements for production against specified guidelines</p> <p>4.4.Identify and consult with <b>support services</b> required for production</p> <p>4.5.Produce a prototype and evaluate against design brief requirements</p> <p>4.6.Analyse prototype and determine any further adjustments to production requirements</p> <p>4.7.Finalise production specifications supported by accurate and complete <b>documentation</b></p>
5. Complete production of work	<p>5.1.Collect and/or organise required components for the work</p> <p>5.2.Produce or monitor the production of work ensuring all parameters of design brief are met</p> <p>5.3.Accurately document work progress in a format appropriate to the nature of the design and requirements of design brief</p> <p>5.4.Seek client approval for work where appropriate</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

- communication skills to liaise with clients and colleagues on design concepts, and to effectively present potentially complex ideas
- creative thinking skills to generate and explore a range of possible responses to design brief requirements
- critical thinking and problem-solving skills to work out different ways of meeting different design and production challenges
- Research, literacy and analytical skills to interpret a brief and to source and evaluate information pertinent to the brief
- planning and organisational skills to integrate and coordinate creative, communication and planning issues into the work process
- self-management skills to take pro-active responsibility for all the elements involved in responding to a design brief.

### Required knowledge

- copyright, moral rights and intellectual property issues and legislation relevant to the ways design concepts are developed and presented
- different ways of presenting, communicating and documenting design concepts (as relevant to the context of work)
- format of design brief typically used in the relevant industry or design context
- principles and key features of project management relevant to a design project
- specific project management factors that apply to a design project
- terminology typically used in a range of design briefs.

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Evidence of the following is essential:

- effective response to the requirements of at least two design briefs, including interpretation, concept development, communication and production planning
- knowledge of copyright, moral rights and intellectual property issues and legislation relevant to the ways

<b>EVIDENCE GUIDE</b>	
	design concepts are developed and presented.
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to the materials resources and equipment needed to interpret design brief, source information pertinent to design brief and to respond to design brief within its parameters</li> <li>• interaction with others to reflect the communication and collaboration aspects of this unit.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• evaluation of design documentation and completed work undertaken by the candidate</li> <li>• oral or written questioning to assess knowledge of typical parameters and constraints for work in a given context, including practical production issues</li> <li>• evaluation of presentation made by the candidate to present concepts and to articulate the creative and other processes that lead to the development of final design concept.</li> </ul>
<b>Guidance information for assessment</b>	The design process does not occur in isolation. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b><i>Specifications</i></b> may refer to:	<ul style="list-style-type: none"> <li>• budget</li> <li>• location</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• materials</li> <li>• media</li> <li>• quantity</li> <li>• scope of work</li> <li>• site</li> <li>• size</li> <li>• target group</li> <li>• timeframes</li> </ul>
<i>Design brief</i> may be:	<ul style="list-style-type: none"> <li>• written</li> <li>• diagrammatic</li> <li>• visual</li> <li>• verbal</li> </ul>
<i>Parameters or constraints</i> may refer to:	<ul style="list-style-type: none"> <li>• budgeting and financing arrangements</li> <li>• cost of production</li> <li>• legislative and regulatory requirements</li> <li>• outlets</li> <li>• number of items</li> <li>• purpose of item</li> <li>• timeframes</li> </ul>
<i>Information pertinent to design brief</i> may be about:	<ul style="list-style-type: none"> <li>• current trends in the application of materials, techniques, tools and equipment</li> <li>• design standards</li> <li>• health and safety</li> <li>• industry standards</li> <li>• legal, contractual, ethical and copyright considerations</li> <li>• material characteristics and capabilities</li> <li>• new technology and innovation</li> <li>• stylistic considerations</li> </ul>
<i>Concepts for work</i> would usually be in written format and may include:	<ul style="list-style-type: none"> <li>• computer generated text or diagrams, for example MS Word PowerPoint presentation</li> <li>• diagrams</li> <li>• drawings</li> <li>• photographs or digital images</li> <li>• text</li> <li>• video</li> </ul>
<i>Agreement on the concept</i> may involve:	<ul style="list-style-type: none"> <li>• development of an artist statement</li> <li>• discussion with client</li> <li>• discussion with other specialists (e.g. technical or production)</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• formal contract for the work</li> <li>• negotiation</li> </ul>
<i>Support services</i> may involve:	<ul style="list-style-type: none"> <li>• agencies</li> <li>• digital services</li> <li>• engineers</li> <li>• fabricators, for example for models, props, sets</li> <li>• hire studios and/or equipment</li> <li>• other specialists, for example make-up, stylists</li> <li>• production facilities</li> <li>• work assistants</li> </ul>
<i>Documentation</i> may include:	<ul style="list-style-type: none"> <li>• charts/diagrams</li> <li>• CD</li> <li>• data sheets with notes</li> <li>• drawings/sketches</li> <li>• illustrations</li> <li>• material samples</li> <li>• photographs or digital images</li> <li>• slides</li> <li>• specifications for fabricators</li> <li>• storyboard and text</li> <li>• video or DVD</li> <li>• written rational or description</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Design - Design Process
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## Co-requisite units

Co-requisite units		

## BSBDES502A Establish, negotiate and refine a design brief

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to work pro actively with a client or commissioning organisation to develop and negotiate a design brief.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals working in any industry or design context where the designer plays a key role in determining the scope and nature of work required. This unit builds on BSBDES402A Interpret and respond to a design brief, which focuses on working with an established brief.</p> <p>Establishment, negotiation and refinement of a design brief requires the integration of highly developed creative thinking, communication and planning skills in a process that may not be linear. Adaptability and effective response to change and new ideas is crucial.</p> <p>In practice, this unit supports and is supported by other units describing the specialist skills and knowledge required by specific design disciplines.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Establish design requirements	<p>1.1. Identify and make appropriate contact with <b><i>relevant stakeholders</i></b> for the design project, in addition to the client</p> <p>1.2. Identify and source <b><i>information and references relevant to the design project</i></b></p> <p>1.3. Undertake <b><i>critical analysis</i></b> of sources and extract key information to inform the design project</p> <p>1.4. Liaise with client and other key stakeholders to determine <b><i>overall objectives and parameters</i></b> for the design project</p> <p>1.5. Pro-actively seek, review and act upon information needed to inform constructive communication with client</p> <p>1.6. Build trust and respect between self and client</p>



ELEMENT	PERFORMANCE CRITERIA
	through effective use of communication skills and demonstration of professional integrity
2. Develop and refine design brief	<p>2.1. Develop concepts and ideas for inclusion in design brief that take account of overall objectives and parameters</p> <p>2.2. Undertake own analysis of concept and challenge ideas and approaches taken to ensure responsiveness to project needs</p> <p>2.3. Present ideas in an <i>appropriate format/medium</i> and seek feedback from key stakeholders</p> <p>2.4. Use effective communication techniques to generate discussion, debate and critical analysis</p> <p>2.5. Re-evaluate and refine options based on own analysis and discourse with others</p> <p>2.6. Establish and agree on final nature and scope of design brief with client and accurately document details</p>
3. Negotiate terms and conditions	<p>3.1. Negotiate and agree <i>terms and conditions</i> of the brief in accordance with relevant <i>organisational and professional standards</i></p> <p>3.2. Clarify, agree and document roles and responsibilities of those involved in the project</p> <p>3.3. Confirm agreements in writing in accordance with <i>organisational requirements</i></p> <p>3.4. Identify the need for and seek specialist advice in developing, formal agreements or contracts where appropriate</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication, presentation and negotiation skills to work with clients to establish and refine design briefs
- creative thinking skills to generate and develop concepts and ideas for the design brief, including responses to situations where parameters may be quite broad and open or very restrictive

**REQUIRED SKILLS AND KNOWLEDGE**

- literacy skills to research and evaluate a wide range of source materials for the development of ideas and concepts
- numeracy skills to develop realistic costings for realisation of design concept
- planning and organisational skills to guide and coordinate the process of negotiating and finalising a design brief
- problem-solving skills to pro-actively identify and develop effective solutions to complex challenges of a varied and unpredictable nature
- self-management skills to take responsibility for driving and guiding the brief negotiation process.

**Required knowledge**

- copyright, moral rights and intellectual property issues and legislation that impact on design in the relevant work context
- legal issues that affect negotiations and contracts in the relevant work context
- scope, nature and potential variations within design briefs relevant to a specific context
- sources of information that inform the development of design concepts within a specific industry context.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- practical demonstration of skills through the development and finalisation of at least two design briefs for a specific industry purpose
- effective collaboration and communication skills to work with others to develop and refine a design brief
- knowledge of the design process within the specific industry context/design discipline.

**Context of and specific resources for assessment**

Assessment must ensure:

- access to appropriate equipment and media to communicate and present ideas and concepts
- access to sources of information relevant to the

<b>EVIDENCE GUIDE</b>	
	<p>industry context</p> <ul style="list-style-type: none"> <li>interaction with and involvement of others to reflect the collaborative nature of the work, and the communication and negotiation skills required.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>evaluation of a design brief in which the candidate has played a significant development role</li> <li>evaluation of reports prepared by the candidate detailing the processes undertaken for establishing and refining the design brief, including challenges faced and lessons learned for the future</li> <li>observation of discussions and negotiations with client and other stakeholders</li> <li>oral or written questioning to assess knowledge of the process and issues surrounding legislation, industry context, sources of information</li> <li>evaluation of candidate response to different scenarios to assess ability to adapt approach to different client requirements and contexts.</li> </ul>
<b>Guidance information for assessment</b>	<p>The design process does not occur in isolation. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>any specialised design unit.</li> </ul>

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>

<b>RANGE STATEMENT</b>	
<b><i>Relevant stakeholders</i></b> in addition to the client may include:	<ul style="list-style-type: none"> <li>• authorities such as local council for outdoor event design</li> <li>• creative specialists</li> <li>• other designers</li> <li>• others involved in the project</li> <li>• production teams</li> <li>• technical specialists</li> <li>• venue managers</li> </ul>
<b><i>Information and references relevant to the design project</i></b> may include:	<ul style="list-style-type: none"> <li>• environment</li> <li>• financial information</li> <li>• legislative and regulatory requirements</li> <li>• music and/or film/video</li> <li>• oral history</li> <li>• organisational information</li> <li>• photographs and other artworks</li> <li>• project team members</li> <li>• promotional material</li> <li>• technical reports/data</li> <li>• texts and other written references</li> <li>• work of other designers/artists</li> </ul>
<b><i>Critical analysis</i></b> may involve:	<ul style="list-style-type: none"> <li>• considering how ideas may be adapted</li> <li>• considering how ideas may be challenged</li> <li>• drawing links between references and potential designs</li> <li>• evaluating work of other designers</li> <li>• making judgements about potential ideas in relation to the budget and available resources</li> <li>• making judgements about relevance of information and ideas</li> </ul>
<b><i>Overall objectives and parameters</i></b> may relate to:	<ul style="list-style-type: none"> <li>• audience</li> <li>• availability of materials, tools, equipment and human resources</li> <li>• budget constraints</li> <li>• conflicting competing demands</li> <li>• environmental sustainability</li> <li>• organisational vision</li> <li>• presentation venue/context</li> <li>• sponsorship</li> <li>• timeframe</li> <li>• triple bottom line (people, planet, profit)</li> </ul>

<b>RANGE STATEMENT</b>	
<i>Appropriate format/medium</i> for presentation of ideas may include:	<ul style="list-style-type: none"> <li>• checklists</li> <li>• digital presentation</li> <li>• drawings</li> <li>• electronic presentations</li> <li>• graphic formats</li> <li>• models</li> <li>• paintings</li> <li>• photographs</li> <li>• plans</li> <li>• prototypes</li> <li>• verbal description/oral presentation</li> <li>• video</li> <li>• visual diagrams</li> </ul>
<i>Terms and conditions</i> may relate to:	<ul style="list-style-type: none"> <li>• conceptual parameters</li> <li>• contracts</li> <li>• deliverables</li> <li>• legal and financial issues such as processes to be used</li> <li>• ownership and copyright</li> <li>• reporting</li> <li>• technical requirements</li> <li>• time lines</li> </ul>
<i>Organisational and professional standards</i> may include:	<ul style="list-style-type: none"> <li>• industry-accepted fee schedules</li> <li>• industry standards for written agreements</li> <li>• requirements for written agreements</li> </ul>
<i>Organisational requirements</i> for confirming agreements may include:	<ul style="list-style-type: none"> <li>• approval and ongoing communication processes</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

Competency field	Design - Design Process
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## Co-requisite units

Co-requisite units		

## BSBDES601A Manage design realisation

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to manage the process of taking a design from concept to final realisation or production.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals working in any industry context or design discipline who take responsibility for turning design concept into reality - a product or service of value to the end user. This person could be an individual designer-maker or a designer working as part of a larger design/production team.</p> <p>The unit has a strong focus on planning, implementation and monitoring skills, combined with a sound knowledge of design and production issues and challenges in a given context.</p> <p>In practice this unit supports and is supported by other units describing the specialist skills and knowledge required by specific design disciplines.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan realisation of the design	1.1. Collect, analyse and maintain <b><i>relevant information on the design</i></b> 1.2. Discuss and agree on <b><i>standards of work and monitoring requirements</i></b> with <b><i>appropriate stakeholders</i></b> 1.3. Develop clear plan and schedule for design realisation, including key roles and responsibilities linked to time lines and budget
2. Implement and monitor realisation of the design	2.1. Organise and/or allocate <b><i>resources</i></b> to achieve the realisation of design within required standards, timeframes and budget 2.2. Liaise with others involved in design realisation to ensure obligations and quality standards are met within time, budget and technical resources



ELEMENT	PERFORMANCE CRITERIA
	<p>2.3.Maintain accurate, relevant and complete <b>documentation</b> in accordance with agreed standards</p> <p>2.4.Monitor process to ensure integrity of design is maintained at all times, including through the process of challenging and interrogating own design work</p> <p>2.5.Promptly identify <b>difficulties or problems</b> that arise in relation to realisation of the design and take action to rectify the situation</p>
3. Liaise and negotiate with stakeholders	<p>3.1.Establish and maintain appropriate <b>communication channels</b> with relevant stakeholders</p> <p>3.2.Pro-actively seek and provide information to facilitate effective design realisation</p> <p>3.3.Adhere to agreed terms and conditions or negotiate appropriate changes in light of changed circumstances</p> <p>3.4.Negotiate and agree on revisions with relevant parties in a professional manner, to enhance quality of outcome</p>
4. Complete design process	<p>4.1.Finalise design outcomes in accordance with terms and conditions</p> <p>4.2.Seek feedback from key stakeholders on finished design and make final adjustments as agreed</p> <p>4.3.Evaluate completed design in relation to own work and overall process, to inform future practice</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication and negotiation skills to lead and participate in effective client/principal, stakeholder and project team liaison during design realisation
- creative thinking skills to generate new or adapted ideas in response to realisation challenges
- literacy skills to research and evaluate a wide range of source materials on design and to complete relevant design documentation
- numeracy skills to manage budgets

**REQUIRED SKILLS AND KNOWLEDGE**

- planning and organisational skills to coordinate and lead potentially complex processes involving a range of interrelated factors and challenges
- problem-solving and decision making skills to develop and implement solutions to unpredictable problems.

**Required knowledge**

- copyright, moral rights, intellectual property issues and legislation that impact on design work in the relevant industry context at a managerial level
- occupational health and safety requirements relevant to the particular work context/design discipline
- production/realisation processes as they apply to designs in a particular industry context or design discipline including materials, tools, equipment and processes
- quality assurance for design concept realisation applicable to the specific industry context/design discipline.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- planning and implementation of design realisation so that finished product or service meets the requirements of design brief
- effective communication and negotiation skills in relation to working with others for design realisation
- knowledge of the design process in the specific industry context/design discipline.

**Context of and specific resources for assessment**

Assessment must ensure:

- access to resources, tools, materials and equipment for realisation of a design in specific context
- access to a design concept that the candidate can take to realisation stage
- interaction with and involvement of others to reflect the collaborative nature of the unit and the communication and negotiation skills required.

<b>EVIDENCE GUIDE</b>	
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• evaluation of finished products or services where the candidate has managed the realisation process</li> <li>• evaluation of progress reports or completion reports prepared by the candidate</li> <li>• evaluation of candidate reports on the realisation process highlighting different management techniques used, challenges in the process and how these were addressed.</li> </ul>
<b>Guidance information for assessment</b>	<p>The design process does not occur in isolation. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• any specialised design unit.</li> </ul>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b><i>Relevant information on the design</i></b> may include:	<ul style="list-style-type: none"> <li>• artwork</li> <li>• brief</li> <li>• checklists</li> <li>• financial data</li> <li>• models</li> <li>• production data</li> <li>• prototypes</li> <li>• specifications</li> <li>• technical data</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• visual diagrams</li> <li>• working drawings</li> </ul>
<i>Standards of work and monitoring requirements</i> may relate to:	<ul style="list-style-type: none"> <li>• budget targets</li> <li>• creative issues</li> <li>• legal issues</li> <li>• reporting requirements</li> <li>• technical quality</li> <li>• timeframes</li> </ul>
<i>Appropriate stakeholders</i> may include:	<ul style="list-style-type: none"> <li>• client</li> <li>• community</li> <li>• others on whom the design will impact, for example technical or production personnel</li> <li>• others working on the design realisation process</li> <li>• supervisor/manager</li> </ul>
<i>Resources</i> may include:	<ul style="list-style-type: none"> <li>• financial</li> <li>• human</li> <li>• physical</li> </ul>
<i>Documentation</i> to be maintained may include:	<ul style="list-style-type: none"> <li>• digital records and presentations</li> <li>• financial reports</li> <li>• models</li> <li>• photographs</li> <li>• progress reports</li> <li>• prototypes</li> <li>• records of work</li> <li>• working drawings</li> </ul>
<i>Difficulties or problems</i> may relate to:	<ul style="list-style-type: none"> <li>• budgetary overruns</li> <li>• conceptual issues</li> <li>• legal issues</li> <li>• scheduling problems</li> <li>• technical quality</li> </ul>
<i>Communication channels</i> may include:	<ul style="list-style-type: none"> <li>• electronic updates</li> <li>• inspections</li> <li>• project meetings</li> <li>• telephone discussions</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Competency field**

<b>Competency field</b>	Design - Design Process
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**Co-requisite units**

<b>Co-requisite units</b>		

## BSBDES602A Research global design trends

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to research and critically evaluate global design trends.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who need to maintain a current and comprehensive knowledge of global design trends to inform their own professional practice. Often the individual would be a designer, but the unit may also be relevant to those who work in related management, marketing and production areas.</p> <p>The unit focuses on research and analysis of information and ideas at a complex level, plus the evaluation and extension of one's own professional skills.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research design trends	1.1. Analyse and select <b><i>formal and informal research strategies</i></b> to source <b><i>information on global design trends</i></b> 1.2. Identify and explore <b><i>new and alternative sources</i></b> 1.3. Evaluate the credibility of information gathered and ensure research scope is sufficiently broad
2. Analyse design trends to inform own practice	2.1. Use information to challenge and extend own perspectives and ways of thinking 2.2. Examine and assess the implications and consequences of design trends on own work 2.3. Use <b><i>critical analysis</i></b> to identify creative or commercial opportunities presented by emerging trends and technologies 2.4. Develop systems to identify and respond to future opportunities
3. Develop and articulate positions	3.1. Develop <b><i>substantiated positions and ideas</i></b> in

ELEMENT	PERFORMANCE CRITERIA
and ideas	<p>relation to global design trends</p> <p>3.2.Generate informed discussion, debate and critical analysis with peers and colleagues</p> <p>3.3.Use debate and feedback as a way of challenging and refining own positions</p>
4. Extend own design skills	<p>4.1.Pro-actively identify and use opportunities presented by research to extend own design skills</p> <p>4.2.Re-evaluate and refine approaches to work in the context of current and emerging trends</p> <p>4.3.Use practice, discussion and ongoing evaluation to continuously improve skills</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to articulate and debate conceptual or technical ideas
- critical thinking skills to distil and synthesise information from varied sources and to develop own positions and ideas on a complex range of issues
- literacy skills to research complex, varied and unfamiliar information sources
- planning and organisational skills to undertake the research process.

#### Required knowledge

- broad global design trends that apply to all design disciplines
- business implications/consequences of adopting trends and emergent technologies
- copyright/moral/intellectual property issues associated with research and with design more broadly
- design industry networks and professional development opportunities - local, national and international
- research methodologies and options
- sources of information on global design, design trends and broader references that may inform emerging and innovative design practice
- specific current and emerging design technologies and trends (at a global level) in at least one area of design.



## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>conducting research on a complex range of design issues, trends and ideas</li> <li>analysing, critiquing and synthesising complex sources to develop own positions and ideas</li> <li>design research</li> <li>knowledge of copyright/moral/intellectual property issues associated with research and with design more broadly.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>use of a current and varied range of familiar and unfamiliar information sources.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>evaluation of research undertaken by the candidate in terms of scope, depth and the level of critical thinking applied</li> <li>direct observation of candidate debating issues arising from research into global design trends</li> <li>oral or written questioning to assess knowledge of global design trends in terms of depth and complexity.</li> </ul>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Formal and informal research strategies*** may include:

- formal study
- participating actively in relevant industry associations
- participating in, and contributing to, discussion through conferences, meetings, seminars, courses and journals
- participating in professional development and other learning opportunities
- reading current literature, including specialist journals and industry magazines
- web research

***Information on global design trends*** may relate to:

- best practice examples
- emerging and future technology
- history
- philosophy
- role of design in the broader social, economic and political environment
- sustainability

***New and alternative sources*** may include:

- inspirations from nature
- work from other areas of community or business activity for example:
  - artists
  - authors
  - business people
  - entertainers
  - film makers
  - historians
  - philosophers
  - photographers
  - scientists

***Critical analysis*** may include:

- analysing and evaluating actions and policies
- clarifying issues, values and standards

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• comparing analogous situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• reading and listening critically</li> </ul>
<i>Substantiated positions and ideas</i> may be those which are:	<ul style="list-style-type: none"> <li>• grounded in appropriate research</li> <li>• result of rational and logical thought</li> <li>• subjected to the analysis of others</li> <li>• supported by relevant information</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Design - Design Process
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## Co-requisite units

<b>Co-requisite units</b>		



## BSBDES701A Research and apply design theory

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to research and apply different theories of design.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to individuals who use sophisticated research and critical analysis skills in the exploration of design, design theory and its application to professional design practice.</p> <p>The scope of the research activity has both significant depth and breadth. A broader, more general approach to the history and theory of design is covered by BSBDES305A Source and apply information on the history and theory of design.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Research design theory	1.1. Use a range of <b><i>research techniques</i></b> to source information about design theory 1.2. Identify and explore <b><i>new, emerging and alternative sources of ideas and thinking</i></b> about design 1.3. Expand own knowledge and understanding of design through review and <b><i>critical analysis</i></b> of information 1.4. Analyse, compare and contrast a range of <b><i>theoretical perspectives and thinking</i></b> on design
2. Apply theories of design to professional practice	2.1. Evaluate the relevance and application of different theories of design based on analysis of <b><i>own professional and personal experience</i></b> 2.2. Analyse the ways in which different aspects of history, theory and other influences are applied, adapted or challenged in practice 2.3. Assess the ways in which theories and thinking about design may be applied in ways that provide <b><i>benefits to individuals, businesses and communities</i></b>

ELEMENT	PERFORMANCE CRITERIA
3. Develop, articulate and debate own perspectives on theories of design	<p>3.1. Take a critical approach to different theories and reflect on own ideas and responses</p> <p>3.2. Develop own <i>substantiated positions</i> in response to research and analysis</p> <p>3.3. Articulate own positions in a manner which demonstrates <i>clarity of thought and conceptual understanding</i> of different theories and thinking</p> <p>3.4. Debate own positions on design showing belief in own and ideas and a willingness to remain open to new perspectives</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to articulate and debate complex concepts
- critical thinking skills to analyse complex information, and to develop and substantiate own positions and responses to theories and thinking around design
- literacy skills to research information dealing with complex concepts and theories
- self-management skills to develop and substantiate own views and ideas.

#### Required knowledge

- different theories of design, including different historical perspectives and current and emerging thinking
- relationship between theories of design and design in practice (in a particular work or broader social context)
- relationships, similarities and differences at a conceptual and practical level between the concepts of design, innovation and creativity
- systemic impacts on design - social, economic, political and environmental.

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• research into past, current and emerging theories of design</li> <li>• development of substantiated positions on design and its application in response to own analysis and research</li> <li>• knowledge of different theories and thinking on design and its application in different social and work contexts.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• use of current and emerging sources of information and thinking on design.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• evaluation of research undertaken by the candidate into design theory and its application</li> <li>• evaluation of candidate's participation in discussion and debate on theories of design</li> </ul>
<b>Guidance information for assessment</b>	<p>The design process does not occur in isolation. Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

<b>RANGE STATEMENT</b>
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and</p>



<b>RANGE STATEMENT</b>	
regional contexts) may also be included.	
<b><i>Research techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• desk research</li> <li>• informal discussions</li> <li>• internet</li> <li>• interviews</li> <li>• literature reviews</li> </ul>
<b><i>New, emerging and alternative sources of ideas and thinking</i></b> may include:	<ul style="list-style-type: none"> <li>• current business theories</li> <li>• government policy</li> <li>• individual in any field of endeavour</li> <li>• innovative organisations</li> <li>• international trends</li> </ul>
<b><i>Critical analysis</i></b> may involve:	<ul style="list-style-type: none"> <li>• adapting</li> <li>• analysing and evaluating actions and policies</li> <li>• challenging</li> <li>• clarifying issues, values and standards</li> <li>• comparing analogous situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• debating and discussing</li> <li>• judging</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• questioning</li> <li>• reading and listening critically</li> <li>• reflecting</li> </ul>
<b><i>Theoretical perspectives and thinking</i></b> may be:	<ul style="list-style-type: none"> <li>• economic</li> <li>• environmental</li> <li>• historical</li> <li>• local, national and international</li> <li>• political</li> <li>• social/cultural</li> </ul>
<b><i>Own professional and personal</i></b>	<ul style="list-style-type: none"> <li>• evaluation of contexts in which creativity has</li> </ul>

<b>RANGE STATEMENT</b>	
<i>experience</i> may include:	<p>flourished</p> <ul style="list-style-type: none"> <li>• evaluation of different attitudes to design and the role of designers</li> <li>• observations of the ways people interrelate with the design process, of the ways people use and adapt designs in daily life</li> <li>• reflection on current political, social and cultural trends</li> <li>• reflection on own experience with any type design process</li> <li>• workplace experience</li> </ul>
<i>Benefits to individuals, businesses and communities</i> may include:	<ul style="list-style-type: none"> <li>• better individual and business relationships</li> <li>• capacity for innovation and invention</li> <li>• greater social cohesion</li> <li>• improved productivity and profit</li> <li>• psychological wellbeing of individuals and communities</li> </ul>
<i>Substantiated positions</i> may be positions which are:	<ul style="list-style-type: none"> <li>• grounded in appropriate research</li> <li>• result of rational and logical thought</li> <li>• subjected to the analysis of others</li> <li>• supported by relevant information</li> </ul>
<i>Clarity of thought and conceptual understanding</i> may be demonstrated by:	<ul style="list-style-type: none"> <li>• ability to exchange and debate ideas with others</li> <li>• appropriate distillation of ideas to suit the required purpose</li> <li>• audience understanding</li> <li>• clear articulation of ideas</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Design - Design Process
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## Co-requisite units

Co-requisite units		

## BSBIPR401A Use and respect copyright

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to use and respect copyright. It covers maintaining control over the copyright owner's work, commercialising copyright material, preventing the unauthorised use of an original work, and using other party's original work legitimately.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to people who may be authors, creators or other owners of works covered by copyright. It also applies to employees who have a role in ensuring that their organisation's copyright is protected and/or that their organisation uses others' copyright appropriately to benefit the organisation without infringing the rights of copyright owners. These people may work in a wide range of industry and business contexts.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>	
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<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify extent of copyright protection for original works	1.1. Research <b><i>copyright</i></b> and its application to original works 1.2. Identify <b><i>legislative requirements</i></b> governing copyright 1.3. Determine the <b><i>copyright owner</i></b> of original works within or used by the organisation 1.4. Research the <b><i>rights of the copyright owner</i></b> , including <b><i>moral rights</i></b> 1.5. Determine whether a <b><i>copyright notice</i></b> is required 1.6. Identify <b><i>sources of information and advice</i></b> regarding copyright issues and use copyright professionals where required
2. Ensure that copyright protection is effective when using	2.1. Identify material within the organisation that may attract copyright 2.2. Identify and review organisation <b><i>policies and</i></b>

ELEMENT	PERFORMANCE CRITERIA
original works	<p><i>procedures</i> to ensure that own and others' original works are protected against <i>direct</i> or <i>indirect infringement</i> of copyright</p> <p>2.3. Implement policies and procedures to protect the organisation's copyright, recognising exceptions that allow the legitimate use of own copyright material by others</p> <p>2.4. Provide advice to relevant personnel about the legal and economic <i>implications of copyright infringement</i></p> <p>2.5. Evaluate and make recommendations for the <i>commercialisation potential</i> of copyright material</p> <p>2.6. Research issues that need to be considered when licensing or selling copyright rights, including the use of <i>copyright collection societies</i></p>
3. Monitor policies and procedures for use of own copyright materials by other parties	<p>3.1. Monitor policies and procedures to ensure that the organisation's copyright is respected <i>locally</i> and <i>internationally</i></p> <p>3.2. Create and maintain documentation in relation to copyright agreements where established</p> <p>3.3. Implement <i>procedures to limit or deter infringement</i> of organisation's copyright and/or encourage the proper use of the organisation's copyright</p> <p>3.4. Make recommendations to appropriate personnel when real or potential infringements of organisation's copyright may require <i>further action</i></p>
4. Monitor policies and procedures for legitimate use of others' copyright materials	<p>4.1. Research when permission is needed to use copyright material belonging to others</p> <p>4.2. Advise appropriate personnel about <i>restrictions</i> on and licensing requirements for the use of others' copyright material, and implement training if required</p> <p>4.3. Advise appropriate personnel of legislative exceptions that allow use of copyright material without permission</p> <p>4.4. Monitor policies and procedures covering organisational use of others' copyright material to ensure it is to the benefit of the organisation</p> <p>4.5. Monitor organisational use of others' copyright material to reduce the risk of infringement</p> <p>4.6. Take action to minimise damage if infringement of others' copyright material occurs</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- research skills to identify a range of issues and information relating to copyright ownership and use
- organisational skills to review and maintain policies and procedures
- communication skills to provide relevant advice to others about copyright protection
- problem solving skills to monitor copyright policies and procedures and make recommendations for action if required
- technology skills to research copyright information

#### Required knowledge

- principal features of legislative framework for copyright and its application to the organisation:
  - Australia
    - Copyright Act 1968 and Copyright Regulations 1969
  - internationally
    - WIPO Treaties, in particular the Berne Convention, the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty
    - International Trade Agreements, in particular the WTO TRIPS Agreement and the impact of free trade agreements to which Australia is a party (including AUSFTA)
- what works are protected by copyright and how long copyright lasts
- rights of copyright owners
- sources of information and advice on copyright
- methods for preventing unauthorised use of copyright material and action to take if infringement of copyright occurs
- when authorisation for use of copyright materials is needed and how to obtain it
- licensing and the role of collecting societies
- open source copyright licences, such as creative commons, AShareNet, NEALS, GPL and other similar licences for copyright material
- impact of the internet on copyright

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• identification of issues for the use, management and protection of original works with copyright</li> <li>• implementation of policies and procedures for the use, management and protection of original works with copyright and legitimate use of others' original material</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to relevant information on the individual or organisation's copyright requirements and procedures</li> <li>• access to reliable and appropriate explanatory material and guidelines</li> <li>• access to appropriate computer resources for establishment and maintenance of policies and procedures</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolio of evidence</li> <li>• oral or written questioning to assess knowledge of copyright and its implications for the organisation</li> <li>• development of action plans for implementation of copyright policies and procedures, and commercialisation of original works</li> <li>• analysis of case studies around copyright issues, with recommendations for action</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• other units from BSB07 including other units relating to intellectual property</li> </ul>



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Copyright refers to:***

- the protection of the original expression of ideas from copying and certain other uses, but not the ideas themselves
- a large range of works, including:
  - works of art and design, and graphic representations, e.g. drawings, maps, community art
  - literature and other written material, e.g. reports, manuals, guides
  - music, e.g. tunes, lyrics
  - sound recordings
  - films and other moving images
  - drama and dance
  - broadcasts
  - computer programs, software, games
  - online or digital content
  - traditional knowledge

***Legislative requirements may include:***

- Copyright Act 1968
- Copyright Regulations 1969

***Copyright owner may be:***

- creator of the work
- employer where the employee creates a work in the course of employment as part of their usual duties, or is contracted to create the work for the employer
- person to whom copyright has been assigned
- person who arranged for a film or sound recording to be made
- person who commissioned design work on a commercial basis
- State, Territory or Federal Government for material created under their direction or control

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>Note: there could be more than one owner of copyright</li> </ul>
<b><i>Rights of the copyright owner</i></b> may include:	<ul style="list-style-type: none"> <li>the exclusive right to reproduce, publish, communicate to the public, publicly perform and adapt material</li> <li>assigning their rights to others so that another party becomes the owner or exclusive licensee of the rights</li> <li>licensing their rights, giving another party the permission to use the copyright material but not own the rights</li> <li>licensing of rights associated with derivative works of copyright material, including: <ul style="list-style-type: none"> <li>exact copies</li> <li>enhancements</li> <li>supplementary works</li> <li>compilations</li> </ul> </li> </ul> <p>(For example license to use computer software programs - specialist legal advice should be obtained)</p> <p>Note: different rights attach to different types of copyright and the term of copyright may also differ</p>
<b><i>Moral rights:</i></b>	<ul style="list-style-type: none"> <li>refer to the personal legal rights of individual creators in the copyright works they have created. They are separate from the economic rights of the copyright owner and may be held by different people</li> <li>include the right of creators: <ul style="list-style-type: none"> <li>to be attributed</li> <li>not to have their work falsely attributed</li> <li>not to have their work treated in a derogatory way</li> </ul> </li> </ul>
<b><i>Copyright notice</i></b> may refer to:	<ul style="list-style-type: none"> <li>the copyright symbol ©</li> <li>name of the copyright owner</li> <li>year of creation or first publication</li> </ul>

<b>RANGE STATEMENT</b>	
	Note: a copyright notice is not required to obtain copyright protection in Australia, but is recommended to clearly indicate to others that the work is protected and to identify the copyright owner
<i>Sources of information and advice</i> may include:	<ul style="list-style-type: none"> <li>• IP Australia</li> <li>• Attorney-General's Department</li> <li>• Australian Copyright Council</li> <li>• State and Commonwealth government agencies</li> <li>• lawyers specialising in intellectual property, including trade mark attorneys and patent attorneys</li> <li>• accountants</li> <li>• business advisors</li> <li>• marketing consultants</li> <li>• branding consultants</li> <li>• copyright collecting societies, e.g. CAL, PPCA, MIPI, APRA, AMCOS</li> <li>• publications</li> <li>• websites, Internet</li> <li>• databases, e.g. local and international trade mark databases</li> </ul>
<i>Policies and procedures</i> may relate to:	<ul style="list-style-type: none"> <li>• information technology and computer usage</li> <li>• computer security measures</li> <li>• employment contracts, including responsibility for intellectual property</li> <li>• confidentiality agreements within the organisation or among people who may need to know about the copyright material, so as to keep the copyright secret prior to commercialisation</li> </ul>
<i>Direct infringement</i> of copyright may include:	<ul style="list-style-type: none"> <li>• when a person, without the copyright owner's permission: <ul style="list-style-type: none"> <li>• reproduces the work (or a substantial portion thereof) in a material form</li> <li>• publishes the work</li> <li>• communicates the work to the public</li> <li>• in the case of literary, dramatic and musical works, performs the work in public</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• adapts the work</li> </ul>
<b><i>Indirect infringement</i></b> of copyright may include:	<ul style="list-style-type: none"> <li>• when a person authorises or facilitates another person to infringe copyright, including through 'inactivity' or 'indifference'</li> <li>• when a person, without the copyright owner's permission, imports certain articles into Australia, e.g. to sell, distribute, exhibit or hire, when the article if made in Australia would have been an infringement of copyright</li> </ul>
<b><i>Implications of copyright infringement</i></b> may include:	<ul style="list-style-type: none"> <li>• legal and economic implications of not complying with copyright legislation</li> <li>• legal and economic implications of others infringing the individual or organisation's copyright</li> </ul>
<b><i>Commercialisation potential</i></b> could include:	<ul style="list-style-type: none"> <li>• licensing or transferring use of original work</li> <li>• profiting from the sale of the original work</li> <li>• developing a product or creative work under a government grant or other funding source and taking it to a commercial product stage</li> </ul>
<b><i>Copyright collection societies</i></b> refer to:	<ul style="list-style-type: none"> <li>• societies that license, collect and distribute royalties on behalf of the copyright owners they represent</li> </ul>
<b><i>Locally</i></b> refers to:	<ul style="list-style-type: none"> <li>• copyright protection within Australia which, under the Copyright Act 1968, exists automatically when something is written down or recorded in accordance with the requirements of the copyright legislation</li> </ul>
<b><i>Internationally</i></b> refers to:	<ul style="list-style-type: none"> <li>• copyright protection in other countries. Copyright is protected by national laws of each country, usually based on international conventions</li> </ul>
<b><i>Procedures to limit or deter infringement</i></b> may include:	<ul style="list-style-type: none"> <li>• making sure there is a copyright notice on all work</li> <li>• statement on works outlining preferred licensing arrangements</li> <li>• access codes in software</li> <li>• encrypting</li> <li>• express agreements on copyright ownership, particularly when work is outsourced</li> </ul>
<b><i>Further action</i></b> could include:	<ul style="list-style-type: none"> <li>• seeking legal advice</li> <li>• contacting publisher if the work is published</li> <li>• civil actions, including informal negotiations</li> </ul>

<b>RANGE STATEMENT</b>	
	and letters of cease and desist <ul style="list-style-type: none"> <li>• court order, including:               <ul style="list-style-type: none"> <li>• order to seize infringing goods</li> <li>• injunctions</li> </ul> </li> <li>• monetary damages/compensation</li> </ul>
<b>Restrictions</b> may include:	<ul style="list-style-type: none"> <li>• not using others' copyright material without authorisation from the copyright owner</li> </ul> Note: there are some limited exceptions: <ul style="list-style-type: none"> <li>• fair dealing for the specific purposes of research or study, criticism or review, and news reporting</li> <li>• reproduction of computer programs, e.g. in the technical processes of running the program, for back-up copy, to correct errors</li> <li>• copying industrial products</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Regulation, Licensing and Risk - Intellectual Property
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## Co-requisite units

<b>Co-requisite units</b>		

## BSBIPR501A Manage intellectual property to protect and grow business

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to protect, secure and effectively use intangible assets of value to an organisation. It focuses on establishing and maintaining systems to protect and exploit an organisation's intellectual property to ensure business growth.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to managers or coordinators who take an active role in recognising, securing and commercialising intangible assets which contribute to the organisation's profitability, productivity, product or service delivery, and market leadership. These managers and coordinators may work in a range of industry or other contexts and may have responsibility for managing people, systems or processes.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the organisation's intellectual property assets and rights	<p>1.1. Identify the <b><i>intangible assets</i></b> residing within the organisation and how they can be protected</p> <p>1.2. Identify the <b><i>sections of the organisation</i></b> in which <b><i>intellectual property</i></b> is created, procured or transferred and for which management is required</p> <p>1.3. Research <b><i>intellectual property rights</i></b> appropriate to the organisation according to <b><i>legislative requirements</i></b></p> <p>1.4. Identify and access <b><i>sources of information and advice</i></b> for protection of the organisation's intellectual property</p> <p>1.5. Conduct a cost-benefit analysis of protecting intellectual property and determine risks</p> <p>1.6. Identify and use appropriate intellectual property</p>

ELEMENT	PERFORMANCE CRITERIA
	professionals to initiate processes to protect intellectual property, according to the type of intellectual property protection required
2. Create a strategy to manage the organisation's intellectual property	<p>2.1. Review or create an organisational strategy, and review or develop policies and procedures for protection, management and use of intellectual property as part of the organisation's business strategy</p> <p>2.2. Plan and implement an <i>intellectual property audit</i> and establish or review the value and use of the organisation's <i>intangible assets</i> inventory</p> <p>2.3. Plan and make recommendations for implementation of a strategy for business growth through use of organisation's intellectual property</p> <p>2.4. Plan and implement <i>strategies</i> to ensure employees, partners and contractors protect the organisation's and others' intangible assets</p> <p>2.5. Establish or review procedures to securely record and store <i>documentation</i> related to the organisation's intangible assets</p>
3. Monitor and maintain organisational strategies for the protection and use of intellectual property	<p>3.1. Monitor and review strategies, policies and procedures for the identification, protection and use of intellectual property regularly to ensure they are working effectively, and make changes if required</p> <p>3.2. Manage the identification of potential <i>infringement</i> of organisation's intellectual property rights, and ensure appropriate action is taken</p> <p>3.3. Promote a culture of <i>compliance</i> and respect for other organisations' and individuals' intellectual property rights</p>
4. Manage the commercialisation of the organisation's intellectual property to ensure business growth	<p>4.1. Research the role intellectual property will play in the strategic plans of the organisation</p> <p>4.2. Contribute to the implementation of the <i>commercialisation</i> of the organisation's intellectual property</p> <p>4.3. Manage the review of the activities of existing or potential competitors and assess their impact on the organisation's intangible assets</p> <p>4.4. Access and effectively use others' intellectual property within legal guidelines for business advantage</p>



## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication and analytical skills to conduct audits and make recommendations for compliance and commercialisation of intellectual property
- interpersonal skills to foster a positive culture of compliance within the organisation
- marketing skills to contribute to the commercialisation of the organisation's intellectual property
- problem solving skills to address intellectual property compliance issues
- research skills to find and interpret relevant legislation in relation to the particular types of intellectual property

#### Required knowledge

- types of intellectual property protection and time restraints on protection
- relevant legislation and regulations relating to intellectual property rights
- potential sources of information and advice about intellectual property
- business and marketing advantages of intellectual property protection
- strategic and business planning
- options for commercialisation

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Evidence of the following is essential:

- identification of the types of intellectual property within the organisation and the relevant legislation protecting them
- establishment or review of strategies, policies and procedures for the management and use of own and others' intellectual property
- identification of commercialisation potential of an

<b>EVIDENCE GUIDE</b>	
	organisation's intellectual property
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to relevant organisational strategies, policies and procedures; or access to information to allow for the design of these policies and procedures</li> <li>• access to relevant legislation and regulations as they relate to intellectual property</li> <li>• access to appropriate computer resources for online search and report preparation</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• analysis of data collected on intangible assets and their compliance requirements within an organisation</li> <li>• direct questioning combined with review of portfolio of evidence and third party workplace reports of on-the-job performance by the candidate, to demonstrate the establishment of strategies, policies and procedures to manage an organisation's intellectual property</li> <li>• third party reports to demonstrate how the candidate promoted a culture of respect for the intellectual property of others</li> <li>• presentation to appropriate personnel on the commercialisation of a range of intellectual property within the organisation</li> <li>• oral or written questioning about relevant legislation as it relates to the organisation's intellectual property</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBRSK501A Manage risk</li> <li>• other management units from BSB07</li> </ul>

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Intangible assets*** may include:

- brand
- business name
- customer/client list
- computer systems software
- confidential information
- copyrights
- core technology
- database/customer list
- design
- distribution agreements
- domain name
- employees' specialist knowledge
- goodwill
- ideas
- innovation
- invention
- logo
- packaging
- patent
- practical application of a good idea
- process
- product
- promotional materials
- secret recipe, process, formula
- standard of service/unique service technique
- trade mark
- trade secret
- training manuals

***Sections of the organisation*** may include:

- any section of the organisation that creates products or services that may be protected by intellectual property rights, or that is responsible for the management of intellectual property, including:
  - design department
  - marketing department

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• research and development department</li> <li>• product development group</li> <li>• human resource department</li> <li>• production, administration or service delivery</li> <li>• legal services unit</li> </ul>
<b><i>Intellectual property</i></b> refers to:	<ul style="list-style-type: none"> <li>• the output of the mind or intellect rather than tangible objects. It includes: <ul style="list-style-type: none"> <li>• copyright</li> <li>• trade marks</li> <li>• patents</li> <li>• designs</li> <li>• plant breeder's rights</li> <li>• circuit layout rights</li> <li>• confidential information/trade secrets</li> </ul> </li> </ul>
<b><i>Intellectual property rights</i></b> may refer to:	<ul style="list-style-type: none"> <li>• the exclusive rights associated with the relevant intangible asset</li> <li>• the right to prevent use by others of the intangible asset</li> </ul>
<b><i>Legislative requirements</i></b> may include:	<ul style="list-style-type: none"> <li>• Business Names legislation</li> <li>• Copyright Act 1968</li> <li>• Designs Act 2003</li> <li>• Patents Act 1990</li> <li>• Trade Marks Act 1995</li> <li>• Trade Practices Act 1974 and State/Territory fair trading legislation</li> </ul>
<b><i>Sources of information and advice</i></b> may include:	<ul style="list-style-type: none"> <li>• IP Australia</li> <li>• Attorney-General's Department</li> <li>• Australian Copyright Council</li> <li>• State and Commonwealth government agencies</li> <li>• lawyers specialising in intellectual property</li> <li>• trade mark attorneys and patent attorneys</li> <li>• accountants</li> <li>• business advisors</li> <li>• marketing consultants</li> <li>• branding consultants</li> <li>• copyright collecting societies, e.g. CAL, PPCA, MIPI, APRA, AMCOS</li> <li>• publications</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>websites, Internet</li> <li>databases, e.g. local and international trade mark databases</li> </ul>
<i>Intellectual property audit</i> may involve:	<ul style="list-style-type: none"> <li>a systematic review of the intellectual property owned, used or acquired by a person or organisation, including: <ul style="list-style-type: none"> <li>products or services that are key to the organisation</li> <li>intangible assets and the legal rights that constitute them in relation to the goods or services</li> <li>what market advantage these rights give the organisation</li> <li>rights under which the organisation uses intellectual property</li> <li>gaps or weaknesses in the organisation's intellectual property and rights</li> </ul> </li> <li>the valuation and recording of such intangible assets in accordance with accepted accounting standards</li> </ul>
<i>Intangible assets</i> refer to:	<ul style="list-style-type: none"> <li>registered forms of intellectual property, such as patents and trade marks</li> <li>unregistrable forms of intellectual property, such as copyright, client lists, know how, staff and training programs</li> </ul>
<i>Strategies</i> may include:	<ul style="list-style-type: none"> <li>preparation of employer, contractor and supplier contracts which protect the organisation's intellectual property, so that: <ul style="list-style-type: none"> <li>the organisation's intellectual property is not introduced into other organisations</li> <li>ownership of the intellectual property is established, e.g. external contractors designing training materials for an organisation</li> </ul> </li> <li>licensing, assignment or transfer of the organisation's intellectual property to other parties for the benefit of the organisation or its stakeholders</li> <li>conducting appropriate clearance searches and investigations</li> </ul>
<i>Documentation</i> may include:	<ul style="list-style-type: none"> <li>deeds</li> <li>registration certificates</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• licence agreements</li> <li>• contract and end user licence agreements</li> <li>• employment contracts</li> </ul>
<b><i>Infringement</i></b> occurs when:	<ul style="list-style-type: none"> <li>• someone consciously or inadvertently uses another party's intellectual property without their permission</li> </ul>
<b><i>Compliance</i></b> is important to:	<ul style="list-style-type: none"> <li>• identify and where necessary take action to prevent breaches of laws and regulations in relation to intellectual property, to:               <ul style="list-style-type: none"> <li>• avoid costly legal decisions</li> <li>• be a good corporate citizen</li> </ul> </li> </ul>
<b><i>Commercialisation</i></b> may include:	<ul style="list-style-type: none"> <li>• utilising intellectual property with the aim of producing financial or other commercial gain, and/or public benefit, including:               <ul style="list-style-type: none"> <li>• adapting</li> <li>• applying</li> <li>• assigning</li> <li>• copying</li> <li>• developing</li> <li>• licensing</li> <li>• making</li> <li>• publishing</li> <li>• selling</li> <li>• using</li> </ul> </li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Regulation, Licensing and Risk - Intellectual Property
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## Co-requisite units

Co-requisite units		

## BSBLED705A Plan and implement a mentoring program

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to plan, develop and implement a mentoring program and to review the outcomes for those involved in the program.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to leaders working to ensure learning advances individual and organisational capabilities.</p> <p>The mentoring program may apply to a:</p> <ul style="list-style-type: none"><li>particular section or group within an educational organisation (for example, as part of a Registered Training Organisation's professional development activities)</li><li>specific business purpose or objective within an enterprise whose core business is not education</li><li>collaborative partnership that spans more than one organisation (such as to advance occupational or industry specific skill needs).</li></ul> <p>This unit may relate equally to small scale learning activities within a small to medium sized organisation or to a significant activity in a large organisation.</p> <p>Leaders in learning must be able to plan, implement, monitor and evaluate a mentoring program that results in learning forged through a defined and active learning partnership with a mentor. The program should develop and use tools that enhance both the learning and the phased relationship, and it should be monitored and evaluated to ensure it explores and meets the mentee's</p>
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	learning needs.
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units	

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan a mentoring program	1.1.Determine benefits of and need for, a <b><i>mentoring program</i></b> 1.2.Define <b><i>mentoring program purpose and objectives</i></b> 1.3.Develop a <b><i>mentoring program plan</i></b> with appropriate <b><i>outcomes</i></b> in consultation with <b><i>key</i></b>

ELEMENT	PERFORMANCE CRITERIA
	<p><i>stakeholders</i></p> <p>1.4. Establish <i>relevant management structures</i> and wider support requirements</p> <p>1.5. Determine <i>mentoring program modes and methods</i></p> <p>1.6. Determine methods and resources required to report on mentoring program outcomes</p>
2. Develop tools and materials to support a mentoring program	<p>2.1. Develop a range of <i>tools and resources</i> appropriate to mentoring program modes and methods</p> <p>2.2. Establish <i>mentor</i> and <i>mentee</i> selection criteria, procedures and tools</p> <p>2.3. Establish <i>formal requirements for the mentor-mentee relationship</i> and communicate these requirements to all parties</p> <p>2.4. Establish rules, procedures and requirements that encompass key <i>accountabilities and responsibilities</i></p> <p>2.5. Develop the means to report and collate outcomes from the mentor-mentee relationship</p>
3. Coordinate mentor and mentee relationships	<p>3.1. Implement strategies for recruiting and accurately <i>matching</i> mentors with mentees</p> <p>3.2. Induct mentors and mentees into the program</p> <p>3.3. Ensure plans required for personal growth are developed by mentors and mentees</p> <p>3.4. Cultivate rapport, mutual trust and teamwork in the mentoring relationship</p> <p>3.5. Consider and address cultural differences and diversity issues in all mentor-mentee communications</p> <p>3.6. Use <i>data and reporting tools</i> supporting the program to monitor the mentor-mentee relationship</p>
4. Evaluate a mentoring program	<p>4.1. Complete <i>mentoring record keeping and reporting</i> requirements using agreed technology, reporting processes and procedures</p> <p>4.2. Evaluate mentoring program against agreed outcomes and report through relevant management structures</p> <p>4.3. Document improvement opportunities for future mentoring programs based on program evaluation</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to:
  - maintain appropriate relationships with colleagues and individuals in the mentoring program
  - establish trust
  - value and be open to, the opinions of others
  - work as part of a team
  - use active listening techniques
  - negotiate
  - encourage and accept feedback
- language skills to:
  - communicate organisational ideas, policies and procedures
  - encourage participation across all levels of personnel and clients
  - seek opinions and elicit feedback from a range of stakeholders
- planning and organising skills to plan a mentoring program and to schedule mentor-mentee interviews and sessions
- problem-solving skills to select and screen applicants for mentoring program, and to assist with resolution of issues that might arise during the program
- self management skills to evaluate personal effectiveness and to manage own time and resources
- teamwork skills to conduct mentor and mentee selection, and to monitor the progress of mentoring program in a team context
- technology skills to undertake record keeping and reporting using agreed technology, and to complete electronic communication and data sharing.

#### Required knowledge

- content and data reporting and storage options
- how to complete the required data collection
- legislation, regulations, codes and policies relevant to the organisation's operations and methods for mentoring
- mentoring program design principles
- relevant communication processes and methods
- reporting methods
- requirements for mentoring tools
- screening techniques, and confidentiality and privacy issues.

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• developing mentoring program plan in consultation with others</li> <li>• working within the relevant management structure to gain executive support for mentoring program</li> <li>• facilitating mentor and mentee selection process</li> <li>• knowledge of relevant legislation specifically in relation to confidentiality and privacy.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to an actual workplace or simulated environment</li> <li>• competence is consistently demonstrated over time, and over a range and variety of mentoring programs.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• completion of applied projects or learning activities</li> <li>• direct observation of application of skills in context</li> <li>• oral or written questioning to assess knowledge of mentoring program design principles</li> <li>• review of mentoring program plan.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBLED702A Lead learning strategy implementation</li> <li>• BSBLED706A Plan and implement a coaching strategy</li> <li>• BSBREL701A Develop and cultivate collaborative partnerships and relationships</li> </ul>

**EVIDENCE GUIDE**

- |  |  |
|--|--|
|  | <ul style="list-style-type: none"> <li>• PSPHR616A Manage performance management system</li> <li>• PSPMNGT614A Facilitate knowledge management.</li> </ul> |
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Mentoring program*** is a:

- formal program designed to forge relationships between a mentor and a mentee to achieve outcomes relating to:
  - context
  - individual needs
  - knowledge transfer
  - learning
  - performance
  - support

***Mentoring program purpose and objectives*** may be:

- strategic
- tactical or operational
- quantifiable or quantitative
- varied in duration (short-term versus long-term)
- to target personal, organisational or other outcomes

***Mentoring program plan*** may include:

- administration
- amount of material support
- anticipated outcomes
- content and resources
- program design principles
- facilities and location
- mentee's learning style
- mentor's skills
- method or mode of interaction (i.e. physical or

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• electronic)</li> <li>• omissions</li> <li>• scope</li> <li>• reporting requirements</li> <li>• roles and responsibilities for key individuals (mentors, mentees, program coordinator, steering committees)</li> <li>• workplace application</li> <li>• time lines</li> </ul>
<b><i>Mentoring program outcomes</i></b> may include:	<ul style="list-style-type: none"> <li>• behavioural</li> <li>• compliance</li> <li>• functional</li> <li>• operational</li> <li>• personal</li> </ul>
<b><i>Key stakeholders</i></b> may include:	<ul style="list-style-type: none"> <li>• coordinators</li> <li>• mentees</li> <li>• mentors</li> <li>• organisational management and staff</li> <li>• peers</li> <li>• public</li> <li>• public agencies, especially regulators</li> <li>• suppliers and learning partners</li> </ul>
<b><i>Relevant management structures</i></b> may include:	<ul style="list-style-type: none"> <li>• executive endorsement</li> <li>• grievance procedures</li> <li>• policies and procedures</li> <li>• program coordinators</li> <li>• program management or reference group</li> <li>• program measures and evaluation mechanisms</li> <li>• program reporting mechanisms</li> <li>• resources management and allocation</li> <li>• steering committee</li> </ul>
<b><i>Mentoring program modes and methods</i></b> may vary in terms of:	<ul style="list-style-type: none"> <li>• duration of program or individual sessions</li> <li>• individual or group mentoring: <ul style="list-style-type: none"> <li>• one mentor to one mentee</li> <li>• one mentor to many mentees</li> <li>• many mentors to many mentees</li> </ul> </li> <li>• physical or electronic enablement (i.e. e-mentoring)</li> <li>• peer mentoring versus independent or external mentoring</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• tools and instruments being used</li> </ul>
<b><i>Tools and resources</i></b> may include:	<ul style="list-style-type: none"> <li>• communication fliers and explanatory materials</li> <li>• documents establishing the ground rules of the mentoring relationship</li> <li>• electronic or physical presentation design</li> <li>• instruments for mentor-mentee selection processes</li> <li>• range of technologies (online or computer-based)</li> <li>• templates for personal mentoring plans</li> </ul>
<b><i>Mentor</i></b> is:	<ul style="list-style-type: none"> <li>• an independent person engaged in a two-way communication relationship with a mentee, whose primary role is to provide constant encouragement and assistance that enhances the mentee's attainment of personal and/or work related needs</li> </ul>
<b><i>Mentees</i></b> may include:	<ul style="list-style-type: none"> <li>• an individual engaged in a two-way communication relationship with a mentor primarily aimed at the transfer of wisdom, encouragement and assistance related to personal and/or work related needs</li> <li>• a mentee may also be called a mentoree, candidate, participant, trainee, employee, student</li> </ul>
<b><i>Formal requirements for the mentor-mentee relationship</i></b> include:	<ul style="list-style-type: none"> <li>• compliance</li> <li>• equal employment opportunity</li> <li>• legal</li> <li>• regulatory</li> </ul>
<b><i>Accountabilities and responsibilities</i></b> means:	<ul style="list-style-type: none"> <li>• who is responsible and accountable for given roles, actions and outcomes within the mentoring program</li> </ul>
<b><i>Matching</i></b> criteria may include:	<ul style="list-style-type: none"> <li>• access issues</li> <li>• behaviours</li> <li>• key performance outcome statements or indicators</li> <li>• learning or communication styles</li> <li>• personal or professional attributes</li> <li>• skills and knowledge</li> </ul>
<b><i>Data and reporting tools</i></b> supporting a mentor program may	<ul style="list-style-type: none"> <li>• collaboration modes and means</li> <li>• databases used</li> </ul>

<b>RANGE STATEMENT</b>	
vary in terms of:	<ul style="list-style-type: none"> <li>• information system design</li> <li>• network configuration and access requirements</li> <li>• security and privacy requirements</li> </ul>
<i>Mentoring record keeping and reporting</i> may be:	<ul style="list-style-type: none"> <li>• completed through physical or electronic means</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Workforce Development - Learning and Development
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## Co-requisite units

<b>Co-requisite units</b>		



## BSBLED706A Plan and implement a coaching strategy

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to plan and develop a coaching strategy and to monitor the implementation of the resulting coaching program within an organisational context.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to leaders working to ensure learning advances individual and organisational capabilities.</p> <p>A coaching strategy may be:</p> <ul style="list-style-type: none"><li>•an internal program forming part of the professional development activities of an educational organisation (such as a Registered Training Organisation) or an enterprise whose core business is not education</li><li>•developed for an external client, for example as part of the range of learning services offered or conducted in a collaborative partnership with more than one organisation.</li></ul> <p>Leaders in learning are typically required to develop and implement coaching strategies in a systematic manner and to monitor, review and improve strategies to optimise learning outcomes for individuals and the organisation.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Develop coaching strategy	1.1. Research and review the need for and role of, <b><i>coaching</i></b> within an organisation 1.2. Establish a framework for the <b><i>coaching strategy</i></b> based on <b><i>organisational context and needs</i></b> 1.3. Determine roles, responsibilities and outcomes for <b><i>key individuals</i></b> involved in the coaching strategy 1.4. Develop time lines for coaching strategy implementation in consultation with <b><i>stakeholders</i></b> 1.5. Obtain organisational support for coaching strategy in accordance with organisational procedures
2. Prepare for coaching strategy implementation	2.1. Plan the coaching program and <b><i>coaching models</i></b> to suit the coaching strategy and the organisation's <b><i>worker and employer issues</i></b>

ELEMENT	PERFORMANCE CRITERIA
	2.2.Design induction and training requirements 2.3.Design <i>tools and resources</i> for coaches and trainees 2.4.Analyse <i>legal, regulatory and organisational compliance requirements</i> for coaches 2.5.Establish recruitment processes for coaches and trainees
3. Implement coaching strategy	3.1.Promote coaching program 3.2.Recruit and select coaches and trainees 3.3.Establish tools, mechanisms and procedures for matching and managing the <i>coach-trainee relationship</i> 3.4.Induct, match and brief coaches and trainees
4. Monitor and support coaching strategy	4.1.Ensure coaching strategy is implemented consistent with work practices and operational requirements 4.2.Provide coaches with access to professional development and support necessary to acquit their role effectively and efficiently 4.3.Design <i>techniques and practices for resolving differences</i> and problems in coaching relationships 4.4.Monitor coaching relationships to ensure they are in accordance with organisational policies and procedures 4.5.Recognise and acknowledge the positive contribution individuals make to coaching activities
5. Review and report on coaching strategy	5.1.Collect, analyse and report data in relation to coaching outcomes at individual or group level, in line with organisational context and needs 5.2.Identify and promote ongoing opportunities for coaching in accordance with individual and organisational context and needs 5.3.Evaluate coaching strategy, document findings and present recommendations for improvement to relevant others

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills

- communication skills to:
  - maintain appropriate relationships with colleagues and individuals involved in coaching
  - establish trust
  - value and be open to, the opinions of others
  - work as part of a team
  - use active listening techniques
  - negotiate
  - encourage and accept feedback
- learning skills to:
  - develop a learning strategy based on applied research
  - design coaching tools and resources
  - conduct induction processes
- planning and organising skills to:
  - plan coaching program
  - frame a coaching strategy within available resources
  - schedule coaching sessions
- problem-solving skills to:
  - select and screen applicants for a coaching program
  - assist with resolution of issues that might arise during the program
  - conduct needs assessments
- teamwork skills to select and match coaches and trainees, and to consult with and influence a team to effectively deploy coaching strategies
- technology skills to communicate electronically with stakeholders and coaches, and to use technology to facilitate coaching.

### Required knowledge

- basic coaching techniques
- coaching program design principles
- communication processes and methods
- data collection methods
- human psychological development
- legislation, regulations, policies, procedures and guidelines relating to workplace coaching
- reporting methods
- requirements for tools used in coaching processes.

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• developing a coaching strategy in consultation with relevant others</li> <li>• working within the relevant management structure to gain executive support for coaching strategy</li> <li>• adhering to legal and regulatory compliance</li> <li>• recruiting suitable coaches</li> <li>• formation of robust relationships between all parties</li> <li>• knowledge of relevant legislation specifically in relation to confidentiality and privacy.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to an actual workplace or simulated environment</li> <li>• competence is consistently demonstrated over time, and over a range and variety of coaching strategies.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• completion of applied projects or learning activities relating to planning, monitoring and reviewing a coaching strategy for an organisation</li> <li>• direct observation of application of skills in context</li> <li>• oral or written questioning to assess knowledge of coaching program design principles</li> <li>• review of tools and resources designed for coaches and trainees.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBLED702A Lead learning strategy</li> </ul>

**EVIDENCE GUIDE**

	<p>implementation</p> <ul style="list-style-type: none"> <li>• BSBLED705A Plan and implement a mentoring program</li> <li>• BSBREL701A Develop and cultivate collaborative partnerships and relationships</li> <li>• PSPHR616A Manage performance management system</li> <li>• PSPMNGT614A Facilitate knowledge management.</li> </ul>
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Coaching*** is:

- a defined relationship designed to enhance performance
- an activity requiring good interpersonal relations
- an activity which emphasises action or improved performance in a specific area
- focussed on the acquisition of job skills and knowledge, and is generally short-term
- frequently identified in personal learning and development plans
- not necessarily managed in a hierarchical relationship (such as being coached by one's supervisor)
- results oriented
- performance or goal directed
- provided by a coach who:
  - maintains confidentiality
  - monitors performance
  - provides learning opportunities
  - provides constructive feedback
  - may have undertaken training or

<b>RANGE STATEMENT</b>	
	development for the role
<b><i>Coaching strategy</i></b> may include:	<ul style="list-style-type: none"> <li>• administration</li> <li>• amount of material support</li> <li>• application in the workplace</li> <li>• content and resources</li> <li>• expected outcomes</li> <li>• facilities and location</li> <li>• method or mode of interaction (i.e. physical or electronic)</li> <li>• preferred learning style of person being coached</li> <li>• roles and responsibilities for key individuals</li> <li>• reporting requirements</li> <li>• required coaching skills and methods</li> <li>• scope</li> <li>• time lines</li> </ul>
<b><i>Organisational context and needs</i></b> may be:	<ul style="list-style-type: none"> <li>• stated in learning and development, and human resources strategies</li> <li>• shaped by desired outcomes including: <ul style="list-style-type: none"> <li>• behavioural</li> <li>• compliance</li> <li>• functional</li> <li>• operational</li> </ul> </li> <li>• organisational sociocultural circumstances and issues (for example, within Indigenous organisations)</li> <li>• personal</li> </ul>
<b><i>Key individuals</i></b> involved in the coaching strategy include:	<ul style="list-style-type: none"> <li>• coaches</li> <li>• coaching program coordinator</li> <li>• steering committees</li> <li>• trainees</li> </ul>
<b><i>Stakeholders</i></b> may include:	<ul style="list-style-type: none"> <li>• associations</li> <li>• Boards/committees of management</li> <li>• coaches</li> <li>• coaching coordinators</li> <li>• employees</li> <li>• government</li> <li>• organisational management and staff</li> <li>• private sector organisations/businesses</li> <li>• public sector organisations/agencies, especially</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>regulators</li> <li>• trainees</li> <li>• suppliers and learning partners</li> <li>• unions</li> </ul>
<i>Coaching models</i> may include:	<ul style="list-style-type: none"> <li>• face to face</li> <li>• virtual of e-mentoring</li> <li>• individual or group based</li> <li>• problem drive (by work, time, tasks, area of expertise, etc)</li> <li>• personal (driven by individual needs not by imposed third party requirements such as work needs)</li> </ul>
<i>Worker and employer</i> issues may include:	<ul style="list-style-type: none"> <li>• certified agreements</li> <li>• contract work and self employment</li> <li>• enterprise bargaining</li> <li>• industrial awards</li> <li>• occupational health and safety</li> <li>• terms and conditions</li> <li>• trade unions</li> </ul>
<i>Tools and resources</i> may be:	<ul style="list-style-type: none"> <li>• communication fliers and explanatory materials</li> <li>• documents establishing the ground rules of the coaching relationship</li> <li>• electronic or physical presentation design</li> <li>• instruments for coach-trainee selection processes</li> <li>• range of technologies (online or computer-based)</li> <li>• templates for personal coaching plans</li> </ul>
<i>Legal, regulatory and organisational compliance requirements</i> may include:	<ul style="list-style-type: none"> <li>• commonwealth and state/territory legislation such as workplace relations legislation, and copyright and privacy laws as they relate to physical materials and electronic technology</li> <li>• competency standards</li> <li>• licensing requirements</li> <li>• plagiarism</li> <li>• relevant organisational policies, codes of practice and national standards</li> <li>• security of information</li> </ul>
<i>Coach-trainee relationship</i> may	<ul style="list-style-type: none"> <li>• access issues</li> <li>• behaviours</li> </ul>



<b>RANGE STATEMENT</b>	
include:	<ul style="list-style-type: none"> <li>• hierarchical relationship (such as being coached by one's supervisor)</li> <li>• key performance outcome statements or indicators</li> <li>• learning or communication styles</li> <li>• location</li> <li>• personal or professional attributes</li> <li>• skills and knowledge</li> </ul>
<i>Techniques and practices for resolving differences</i> may include:	<ul style="list-style-type: none"> <li>• finding a mutually beneficial solution</li> <li>• inviting discussion</li> <li>• providing explanations</li> <li>• not taking it personally when information is rejected or contradicted</li> <li>• not laying blame</li> <li>• self-disclosure</li> <li>• using 'I' messages (focusing on the giver of the message) rather than 'you' messages (focusing on the receiver of the message)</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Workforce Development - Learning and Development
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## Co-requisite units

<b>Co-requisite units</b>		



## BSBLED710A Develop human capital

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to identify human capital; to consult on the advantages of human capital with internal and external stakeholders or collaborative partners; and to develop and monitor the capital value attained through implementation of development activities.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to senior leaders or managers working to enhance individual, team and organisational capabilities.</p> <p>While not all senior leaders and managers will operate within an organisation that acknowledges and treats people as a capital asset, training and related people development activities may be advanced by considering principles and practices relating to the concept of human capital.</p> <p>The unit may relate equally to small scale learning activities within a small to medium sized organisation or a significant activity in a large organisation.</p>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify human capital	1.1. Analyse and evaluate the principles of <b><i>human capital</i></b> theory and concepts 1.2. Assess the factors involved in the formation of human capital 1.3. Determine the <b><i>capital asset value</i></b> of human resources in an organisation, an industry or a region 1.4. Determine the relationship between human capital and <b><i>organisational requirements</i></b>
2. Consult on the advantages of human capital development	2.1. Develop and prioritise strategies for deploying human capital development strategies to support the <b><i>organisation training needs profile</i></b> in consultation with <b><i>key stakeholders</i></b> 2.2. Negotiate with key stakeholders on opportunities for collaborative human capital development projects

ELEMENT	PERFORMANCE CRITERIA
3. Develop and monitor human capital development	<p>3.1. Complete <i>human capital needs analysis</i> and development planning according to organisational requirements</p> <p>3.2. Analyse and interpret <i>information and data</i> on human capital gaps and forecasts</p> <p>3.3. Implement <i>options</i> and strategies to develop, attract and retain <i>talent</i></p> <p>3.4. Implement options and actions to optimise asset value of human resources in relation to organisational strategic imperatives</p> <p>3.5. Determine talent and develop the potential of human capital required to meet organisational requirements</p> <p>3.6. Promote the <i>capacity</i> of the organisation, team and individual employees to achieve strategic and personal advantage through effort to develop human capabilities</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to:
  - research and analyse data
  - communicate ideas and organisational policies and procedures
  - seek opinions and to elicit feedback from a range of stakeholders
  - maintain appropriate relationships with colleagues and production staff
  - value and be open to, the opinions of others
  - work as part of a team
  - use active listening techniques
  - negotiate
- planning and organising skills to prepare and consult on a human capital development plan
- problem-solving, initiative and enterprise skills to:
  - evaluate talent and human capital requirements
  - undertake integrative thinking
  - conceptualise and synthesise complex concepts

**REQUIRED SKILLS AND KNOWLEDGE**

- self-management and learning skills to maintain records on talent and human capital for a work group or operational area
- technology skills to complete online research or data collection, and to develop and monitor human capital value using basic computer applications.

**Required knowledge**

- communication processes and methods
- data collection methods
- human capital audit and assessment
- human capital development planning methodologies
- methods to value human capital
- organisational knowledge assets and capital reporting processes
- relationship of human capital to knowledge management and reporting
- relevant legislation, codes and by-laws that affect business operations, especially in regard to occupational health and safety (OHS) and environmental issues, equal opportunity, industrial relations and anti-discrimination.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- accurate assessment of human capital value in an organisation through human capital analysis and measurement
- documentation relating to data collection, and analysis of human capital and relationship to an organisation's knowledge management and human capital strategy
- documentary evidence of human capital audit and production of a talent development plan
- input from a wide range of sources providing evidence in respect to a broad range of activities and situations
- knowledge of human capital audit and assessment.

<b>EVIDENCE GUIDE</b>	
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to an actual workplace or simulated environment</li> <li>• competence is consistently demonstrated over time, and over a range and variety of situations</li> <li>• access to appropriate documentation and resources normally used in the workplace.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>• completion of applied projects or learning activities - such as examining the relationship between human capital and human resource development; knowledge and organisational learning; talent attraction and development; and human capital and organisational agility</li> <li>• completion of an action research project isolating the relationship of human capital to an organisation's intellectual and knowledge capital</li> <li>• direct observation of contextual application of skills</li> <li>• oral or written questioning to assess knowledge of methods to value human capital.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBFIM701A Manage financial resources</li> <li>• BSBLED702A Lead learning strategy implementation</li> <li>• PSPHR616A Manage performance management system</li> <li>• PSPMNGT614A Facilitate knowledge management.</li> </ul>

## Range Statement

### RANGE STATEMENT

**RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b><i>Human capital</i></b> is the:	<ul style="list-style-type: none"> <li>capital asset value of knowledge vested in the individual that can be deployed to maximise organisational and industry competitiveness</li> </ul>
<b><i>Capital asset value</i></b> is the:	<ul style="list-style-type: none"> <li>determination of the value a business may derive from any stock of assets it owns, which can be deployed to create income, or from which interest and future value can be derived</li> </ul>
<b><i>Organisational requirements</i></b> may include:	<ul style="list-style-type: none"> <li>access and equity principles and practices</li> <li>business and performance plans</li> <li>collaborative partnerships and arrangements</li> <li>confidentiality requirements</li> <li>defined resource parameters</li> <li>ethical standards</li> <li>goals, objectives, plans, systems and processes</li> <li>legal and organisational policies, guidelines and requirements</li> <li>OHS policies, procedures and programs</li> <li>organisational sociocultural circumstances and issues (for example, within Indigenous organisations)</li> <li>quality and continuous improvement processes and standards</li> <li>quality assurance and procedures manuals</li> <li>recording and reporting procedures</li> </ul>
<b><i>Organisation training needs profile</i></b> may include:	<ul style="list-style-type: none"> <li>areas where staff may require further development linked to the organisation's goals and reflect: <ul style="list-style-type: none"> <li>age profile</li> <li>composition - full-time, part-time, casual</li> <li>formal education and training backgrounds</li> <li>gender ratio</li> <li>language and cultural backgrounds</li> <li>occupational groups</li> <li>organisational change programs</li> </ul> </li> </ul>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• roster and shiftwork arrangements</li> </ul>
<b>Key stakeholders</b> may include:	<ul style="list-style-type: none"> <li>• customers</li> <li>• instructional designers</li> <li>• instructors</li> <li>• learners</li> <li>• management and staff</li> <li>• members of the public</li> <li>• peers</li> <li>• public agencies, especially regulators</li> <li>• suppliers and learning partners</li> </ul>
<b>Human capital needs analysis</b> is the:	<ul style="list-style-type: none"> <li>• determination of the gap between the human capital an individual, group, organisation or wider grouping (e.g. society or industry) requires as opposed to what is currently available</li> </ul>
<b>Information and data</b> analysis will usually occur through deployment of:	<ul style="list-style-type: none"> <li>• business technology</li> <li>• software applications able to assess human capital</li> <li>• analysis methods such as: <ul style="list-style-type: none"> <li>• data sampling</li> <li>• feedback on results</li> <li>• peer review</li> <li>• qualitative and quantitative processes</li> <li>• review of previous research</li> <li>• statistical analysis</li> </ul> </li> </ul>
<b>Options</b> for the purposes of human capital development planning may include:	<ul style="list-style-type: none"> <li>• availability of resources, such as financial resources, and information technology and systems</li> <li>• consultancy services</li> <li>• developing in-house capacity to meet identified needs</li> <li>• identifying training or assessment organisations to meet needs</li> <li>• identifying specific units of competency, Australian Qualifications Framework (AQF) qualifications or skill sets to meet needs</li> <li>• time lines</li> <li>• urgency</li> </ul>
<b>Talent</b> concerns the:	<ul style="list-style-type: none"> <li>• total potential an individual brings to an organisation within both current and future contexts</li> </ul>

**RANGE STATEMENT***Capacity* includes:

- all innate and explicit competencies and capabilities able to be deployed to achieve desired outcomes in both current and future contexts

**Unit Sector(s)****Unit sector****Competency field****Competency field**

Workforce Development - Learning and Development

**Co-requisite units****Co-requisite units**


## BSBPMG522A Undertake project work

### Modification History

Release	Comments
Release 1	<p>This version first released with <i>BSB07 Business Services Training Package Version 8.0</i>.</p> <p>Replaces BSBPMG510A Manage projects.</p>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to undertake a straightforward project or a section of a larger project. This unit addresses the management of projects, including developing a project plan, administering and monitoring the project, finalising the project, and reviewing the project to identify lessons learned for application to future projects.

### Application of the Unit

The unit focuses on the application of project-management skills and the requirement to meet timelines, quality standards, budgetary limits and other requirements set for the project.

The unit does not apply to specialist project managers. For specialist project managers, the other units of competency in the project management field (BSBPMG) will be applicable.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Element	Performance Criteria
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Define project	1.1 Access <b><i>project scope and other relevant documentation</i></b> 1.2 Define project stakeholders 1.3 Seek clarification from <b><i>delegating authority</i></b> of issues related to project and <b><i>project parameters</i></b> 1.4 Identify limits of own responsibility and reporting requirements 1.5 Clarify relationship of project to other projects and to the organisation's objectives 1.6 Determine and access available resources to undertake project
2. Develop project plan	2.1 Develop <b><i>project plan</i></b> in line with the project parameters 2.2 Identify and access appropriate <b><i>project-management tools</i></b> 2.3 Formulate risk-management plan for project, including work health and safety (WHS) 2.4 Develop and approve project budget 2.5 Consult team members and take their views into account in planning the project 2.6 Finalise project plan and gain necessary approvals to commence project according to documented plan
3. Administer and monitor project	3.1 Take action to ensure project team members are clear about their responsibilities and the project requirements 3.2 Provide <b><i>support for project team members</i></b> , especially with regard to specific needs, to ensure that the quality of the expected outcomes of the project and documented time lines are met 3.3 Establish and maintain <b><i>required record-keeping systems</i></b> throughout the project 3.4 Implement and monitor plans for managing project finances,

	<p><b>resources</b> and quality</p> <p>3.5 Complete and forward project reports as required to stakeholders</p> <p>3.6 Undertake <b>risk management</b> as required to ensure project outcomes are met</p> <p>3.7 Achieve project deliverables</p>
4. Finalise project	<p>4.1 Complete financial record keeping associated with project and check for accuracy</p> <p>4.2 Ensure transition of staff involved in project to new roles or reassignment to previous roles</p> <p>4.3 Complete project documentation and obtain <b>necessary sign-offs</b> for concluding project</p>
5. Review project	<p>5.1 Review project outcomes and processes against the project scope and plan</p> <p>5.2 Involve team members in the project review</p> <p>5.3 Document lessons learned from the project and report within the organisation</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication and negotiation skills to work with team members and other stakeholders to maintain project schedules
- communication skills to relate to people with diverse abilities and from diverse backgrounds in a culturally appropriate way
- literacy skills to read, write and review a range of documentation
- numeracy skills to:
  - analyse data
  - compare time lines and promotional costs against budgets
- planning and organising skills to develop, monitor and maintain implementation schedules.

### Required knowledge

- organisation's mission, goals, objectives and operations and how the project relates to them
- organisational structure, and lines of authority and communication in the organisation
- relevant legislation and codes from all levels of government that may affect aspects of business operations, including:
  - anti-discrimination legislation
  - codes of practice
  - environmental issues
  - ethical principles
  - WHS
  - privacy laws.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• developing a project plan</li> <li>• examples of monitoring arrangements and evaluation of the efficacy of the project plan in addressing project time lines and budget</li> <li>• knowledge of relevant legislation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to workplace project documentation</li> <li>• demonstration of all required skills, knowledge and performance in a workplace-based project.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third-party workplace reports of on-the-job performance by the candidate</li> <li>• observation of presentations</li> </ul>

	<ul style="list-style-type: none"> <li>oral or written questioning to assess knowledge of the organisation's mission, goals, objectives and operations and how the project relates to them</li> <li>review of project risk-management plan and project plan</li> <li>evaluation of project reports forwarded to stakeholders</li> <li>analysis of documentation reviewing project outcomes and processes against the project scope and plan</li> <li>evaluation of documentation outlining lessons learned from the project.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>other project management units.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Project scope and other relevant documentation</i></b> may include:	<ul style="list-style-type: none"> <li>contract or other agreement</li> <li>project brief</li> <li>project plan or summary</li> <li>other documents outlining: <ul style="list-style-type: none"> <li>expected outcomes of the project</li> <li>inclusions and exclusions from project</li> <li>project resources</li> <li>quality standards for project</li> <li>timeframes for project.</li> </ul> </li> </ul>
<b><i>Stakeholders</i></b> may include:	<ul style="list-style-type: none"> <li>clients or customers (internal and external)</li> <li>funding bodies</li> <li>management, employees and relevant key personnel (internal and external) with special responsibilities</li> <li>project sponsor.</li> </ul>
<b><i>Delegating authority</i></b> may include:	<ul style="list-style-type: none"> <li>customer or client</li> <li>funding body</li> <li>manager or management representative</li> </ul>

	<ul style="list-style-type: none"> <li>project sponsor.</li> </ul>
<b>Project parameters</b> may include:	<ul style="list-style-type: none"> <li>project finances or budget</li> <li>integration of project within organisation</li> <li>legislative and quality standards</li> <li>physical, human and technical resources available or required for project</li> <li>procurement requirements associated with project</li> <li>reporting requirements</li> <li>risks associated with project, including WHS</li> <li>scope of project</li> <li>time lines.</li> </ul>
<b>Project plan</b> may include:	<ul style="list-style-type: none"> <li>details of how the project will be managed</li> <li>roles and responsibilities</li> <li>time lines</li> <li>work breakdown structure.</li> </ul>
<b>Project management tools</b> may include:	<ul style="list-style-type: none"> <li>cost schedule control system</li> <li>Critical Path Method</li> <li>Gantt and bar charts</li> <li>life cycle cost analysis</li> <li>logistics support analysis</li> <li>PERT charts</li> <li>project management software</li> <li>risk and issues logs</li> <li>spreadsheets</li> <li>technical resources required for the project, for example WHS management-system tools.</li> </ul>
<b>Support for project team members</b> may include:	<ul style="list-style-type: none"> <li>additional physical, human and technical resources (within allocated budget) if and as required</li> <li>encouragement</li> <li>feedback</li> <li>learning and development</li> <li>regular project team meetings</li> <li>supervision, mentoring and coaching.</li> </ul>
<b>Required record-keeping systems</b> may include systems for:	<ul style="list-style-type: none"> <li>correspondence</li> <li>financial data, including costs, expenditure, income generated and purchases</li> <li>project outcomes</li> <li>quality data, including any test results</li> <li>recording of time spent on project and progress in completing project</li> <li>samples, prototypes and models.</li> </ul>



<b>Resources</b> may include:	<ul style="list-style-type: none"><li>• human</li><li>• physical</li><li>• technical.</li></ul>
<b>Risk management</b> may include:	<ul style="list-style-type: none"><li>• changing roles and responsibilities in project team</li><li>• negotiating an extension of deadline, or redefining completion or quantity or quality of outcomes</li><li>• outsourcing some aspects of the project</li><li>• reducing costs</li><li>• researching and applying more efficient methods for completing project tasks</li><li>• seeking further resources to meet deadline</li><li>• sharing ideas to gain improvements to work undertaken in the project.</li></ul>
<b>Necessary sign-offs</b> may be required by:	<ul style="list-style-type: none"><li>• clients</li><li>• funding body</li><li>• management</li><li>• project sponsor.</li></ul>

## Unit Sector(s)

Management and Leadership – Project Management

## BSBREL701A Develop and cultivate collaborative partnerships and relationships

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to establish collaborative partnerships and relationships with business and industry stakeholders to promote and advance learning programs.</p> <p>The unit also covers communicating to influence others, cultivating new and existing partnerships, establishing positive collaborative relationships, leading the establishment of a partnership program and establishing reporting mechanisms.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to leaders or managers working in either an educational organisation or a non educational enterprise where learning is used to build capabilities. It includes forming partnerships or other collaborative arrangements to achieve improved learner, community, career, or work outcomes.</p> <p>Educational leaders gain the respect of colleagues, contacts, clients and the community through demonstrating professionalism in all aspects of their work; this professionalism is underpinned by their educational expertise and effective interpersonal and communication skills. In the vocational education and training sector, learning leaders and managers must build partnerships and lead in a collaborative manner to ensure learning has a strategic role in the ever changing context, and in the face of complex influences that affect learning.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Communicate to influence relevant individuals and stakeholders	<p>1.1. Generate trust, confidence and support from <i>relevant individuals</i>, other <i>stakeholders</i> and <i>potential learners</i> by demonstrating a high standard of personal performance and conduct</p> <p>1.2. Implement <i>communication strategies</i> to represent the organisation positively to media, local community and stakeholders</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>1.3. Make decisions in consultation with relevant stakeholders and relevant individuals where appropriate</p> <p>1.4. Use a range of <i>influencing strategies</i> to increase commitment from staff and stakeholders to achieve organisational requirements and to contribute to desired culture</p> <p>1.5. Undertake selected community and/or professional engagements that project a positive image of the organisation to the broader community and stakeholders</p>
2. Cultivate new and existing partnerships with stakeholders	<p>2.1. Establish outcomes to be achieved from a learning <i>partnership</i></p> <p>2.2. Analyse models for effective consultation and collaboration within a partnership</p> <p>2.3. Cultivate <i>collaborative communities</i> and partnerships through application of a range of learning and communication solutions</p> <p>2.4. Forge relationships, collaborative communities or partnerships between a <i>training and assessment organisation</i> and a <i>public or private sector enterprise</i></p> <p>2.5. Consult stakeholders to establish vocational education and training <i>partnership learning programs</i></p>
3. Establish positive collaborative relationships	<p>3.1. Establish processes that contribute to the creation and maintenance of a positive culture that embraces collaboration</p> <p>3.2. Establish processes to <i>resolve conflict in a fair, equitable and collaborative manner</i></p> <p>3.3. Organise and allocate work activities in a cost effective and equitable manner with clear, quantifiable and agreed <i>performance standards</i></p> <p>3.4. Encourage staff to embrace a learning culture and to undertake activities that develop their personal competence and performance</p> <p>3.5. Empower individuals to develop their own ways of working within agreed boundaries of competence, cultural, <i>diversity</i> and <i>organisational and legal requirements</i></p> <p>3.6. Establish <i>indicators</i> and <i>feedback processes</i> that can be used to evaluate the health of the work environment</p>

ELEMENT	PERFORMANCE CRITERIA
4. Lead establishment of a partnership program	<p>4.1. Identify and address <b><i>relevant organisational policies and procedures</i></b> in partnership learning program plans</p> <p>4.2. Identify and incorporate relevant legal requirements into planning of learning programs established in a community or partnership setting</p> <p>4.3. Form partnership learning programs in collaborative and consultative processes involving public or private sector enterprises</p> <p>4.4. Plan and allocate <b><i>resource requirements</i></b> to accomplish a partnership learning program</p> <p>4.5. Establish relevant organisational policies and procedures relating to partnerships, and training and assessment services</p>
5. Establish reporting mechanisms for partnership program	<p>5.1. Establish <b><i>reporting systems</i></b> for <b><i>reporting results</i></b>, that meet <b><i>reporting requirements</i></b>, against planned partnership outcomes</p> <p>5.2. Implement <b><i>reporting systems</i></b> to map learner progress against partnership outcomes</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- analysis and interpretation skills to:
  - evaluate organisational information management systems, policies and procedures
  - select relevant evaluation information and documentation
  - identify any potential and current non-compliance
  - access and interpret organisation's standards and values
  - analyse records or notes of the evaluation process
- initiative and enterprise skills to establish collaborative partnerships and relationships
- interpersonal and communication skills to negotiate, to question, to listen and investigate, to network and clarify issues
- planning and organising skills to:
  - research and evaluate validation processes, and to determine and implement

**REQUIRED SKILLS AND KNOWLEDGE**

- improvements to these processes
  - develop and establish agreement to plans
- problem-solving skills to review feedback and to plan improvements
- teamwork skills to lead and motivate a team in establishing productive networks, partnerships and other relationships.

**Required knowledge**

- relevant legislation that affects the business operation, especially in regard to OHS and environmental issues, equal opportunity and anti-discrimination, industrial relations
- organisation mission, purpose and values
- organisation objectives, plans and strategies
- leadership styles
- personal development planning methodologies
- data collection methods
- external environment scanning relating to social, political, economic and technological developments
- emotional intelligence and its relationship to individual and team effectiveness
- organisational transformation and the management of the stages of change
- organisational design and building in responsiveness of operations to change in customer or market conditions.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- demonstrated capacity to foster learning partnerships, conduct stakeholder consultation and use strategic and personally enhancing communication skills
- developing collaborative approaches to enhance individual, team and organisational outcomes
- initiating and implementing learning program partnerships in line with relevant regulatory, employment and organisational requirements

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>knowledge of relevant policy, legislation, codes of practice and national standards.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>competence is consistently demonstrated over time, and over a range and variety of situations</li> <li>access to required assessment facilities and resources.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>direct questioning combined with review of portfolios of evidence and third party workplace reports of on-the-job performance by the candidate</li> <li>review of applied projects or learning activities, especially relating to formation of professional networks and stakeholder consultation in relation to forming partnerships for vocational education and training programs</li> <li>direct observation of contextual application of skills</li> <li>submission of a portfolio of evidence including previous work forging partnerships</li> <li>oral or written questioning to assess knowledge of development of industry learning partnerships.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>BSBLED702A Lead learning strategy implementation</li> <li>BSBLED707A Establish career development services</li> <li>BSBLED709A Identify and communicate trends in career development</li> <li>PSPMNGT614A Facilitate knowledge management.</li> </ul>

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating

**RANGE STATEMENT**

conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Relevant individuals*** may include:

- employees
- employers
- government agencies and departments
- learners/students
- industry associations, employer bodies, professional associations
- industry representatives
- national Industry Skills Councils
- people working in the roles targeted by training
- regulatory and licensing authorities
- research agencies
- state/territory industry training advisory bodies
- subject or technical specialists or experts
- unions
- universities

***Stakeholders*** may include:

- administrative and regulatory bodies
- coordinators, teachers, assessors, coaches, mentors and support staff
- employees
- industry, employee, employer, professional and peak bodies or associations
- learners/students
- other training and assessment organisations
- public or private sector enterprise

***Potential learners*** may include:

- apprentices and trainees
- current or ongoing learners and clients
- existing industry and enterprise employees
- individuals changing careers
- individuals learning new skills and knowledge
- individuals or groups meeting licensing or other regulatory requirements
- individuals seeking to upgrade competencies
- individuals who are unemployed
- individuals who have a disability
- members of target groups such as Aboriginal and Torres Strait Islander communities



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• overseas learners and international students</li> <li>• potential learners and clients</li> <li>• recent migrants and people from culturally and linguistically diverse backgrounds</li> <li>• school leavers, new entrants to the workforce</li> </ul>
<i>Communication strategies</i> may include:	<ul style="list-style-type: none"> <li>• conducting presentations</li> <li>• developing and applying interview and interpersonal communication protocols</li> <li>• developing and circulating marketing materials</li> <li>• developing promotional materials and course outlines</li> <li>• initiating and conducting a public communication strategy</li> </ul>
<i>Influencing strategies</i> may include:	<ul style="list-style-type: none"> <li>• debate</li> <li>• dialogue</li> <li>• discussion</li> <li>• formal and informal techniques</li> <li>• levels of participation</li> <li>• moderated negotiations</li> <li>• networking</li> <li>• strategies applied face-to-face or collectively (e.g. in a learning community or community of practice)</li> </ul>
<i>Partnerships</i> may:	<ul style="list-style-type: none"> <li>• be informal</li> <li>• be physical or virtual (e.g. online)</li> <li>• involve a formal agreement</li> <li>• involve one or more enterprises, and training and assessment organisations</li> <li>• involve one or more learning programs</li> </ul>
<i>Collaborative communities</i> may include:	<ul style="list-style-type: none"> <li>• communities of practice</li> <li>• formal or informal relationships</li> <li>• informal and formal groups in collaborative relationships</li> <li>• knowledge communities</li> <li>• knowledge networks</li> <li>• learning communities</li> <li>• physical or virtual relationships</li> <li>• supply chain communities</li> <li>• virtual circles</li> </ul>
<i>Training and assessment</i>	<ul style="list-style-type: none"> <li>• organisation that delivers non-recognised vocational education and training</li> </ul>

<b>RANGE STATEMENT</b>	
<b><i>organisation</i></b> may include:	<ul style="list-style-type: none"> <li>• organisation working in a partnership arrangement with an RTO to deliver recognised vocational education and training</li> <li>• RTO delivering recognised vocational education and training services such as TAFE institutes, private commercial colleges and organisations, enterprises, community organisations, group training companies and secondary schools</li> </ul>
<b><i>Public or private sector enterprises</i></b> may include:	<ul style="list-style-type: none"> <li>• community bodies</li> <li>• government agencies</li> <li>• privately owned companies</li> </ul>
<b><i>Partnership learning program</i></b> may include:	<ul style="list-style-type: none"> <li>• accredited course which includes Training Package outcomes</li> <li>• community education program</li> <li>• nationally endorsed qualification from a Training Package or accredited course</li> <li>• part of a VET in Schools program</li> <li>• part of an apprenticeship or traineeship</li> <li>• professional development program</li> <li>• short course or non-recognised vocational program</li> <li>• short-term development plan</li> <li>• short-term induction program</li> <li>• subset of a learning strategy</li> <li>• traineeship or apprenticeship</li> <li>• workplace learning program</li> </ul>
<b><i>Resolving conflict in a fair, equitable and collaborative manner</i></b> may include:	<ul style="list-style-type: none"> <li>• adherence to relevant legislative, legal, workplace requirements</li> <li>• application of organisational complaints procedures</li> <li>• internal or external specialists</li> </ul>
<b><i>Performance standards</i></b> may be based on:	<ul style="list-style-type: none"> <li>• personal or task outcomes</li> <li>• span short- or long-term outcomes</li> <li>• strategic, operational outcomes</li> </ul>
<b><i>Diversity</i></b> includes difference in:	<ul style="list-style-type: none"> <li>• age</li> <li>• belief systems and values</li> <li>• culture</li> <li>• expertise, experience and working styles</li> <li>• gender</li> <li>• interpersonal style</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• interests</li> <li>• language, literacy and numeracy</li> <li>• physical differences</li> <li>• politics</li> <li>• race</li> <li>• religion</li> <li>• sexual orientation</li> <li>• thinking and learning styles</li> </ul>
<i><b>Organisational and legal requirements</b></i> may include:	<ul style="list-style-type: none"> <li>• collaborative and partnership arrangement agreements such as memoranda of understanding</li> <li>• confidentiality and privacy requirements</li> <li>• licensing requirements</li> <li>• requirements for initial and continuing registration as defined in the AQTF Standards for Registered Training Organisations and state/territory legislation and regulations governing provider registration and course accreditation</li> <li>• requirements of awards and enterprise bargaining agreements</li> <li>• requirements of endorsed Training Packages</li> <li>• requirements of other relevant commonwealth and state/territory legislation, for example relating to matters such as OHS, anti-discrimination, workplace and industrial relations, workers compensation, apprenticeships and traineeships</li> <li>• requirements set by professional associations</li> <li>• requirements set by quality systems</li> </ul>
<i><b>Indicators</b></i> may include:	<ul style="list-style-type: none"> <li>• formal human resources and related indicators to provide benchmark, comparative measures on: <ul style="list-style-type: none"> <li>• average hours in relation to output per employee</li> <li>• down-time</li> <li>• related operational and planning indicators</li> <li>• revenue per employee/team</li> <li>• staff absenteeism</li> <li>• staff satisfaction</li> <li>• staff turnover</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• training hours</li> </ul>
<i>Feedback processes</i> include:	<ul style="list-style-type: none"> <li>• formal complaints or suggestions procedures</li> <li>• formal-informal</li> <li>• independent audits</li> <li>• management audits/workplace checks</li> <li>• surveys</li> <li>• virtual or physical</li> <li>• whistleblower policy</li> </ul>
<i>Relevant organisational policies and procedures</i> may include:	<ul style="list-style-type: none"> <li>• access and equity</li> <li>• assessment procedures and options</li> <li>• client services</li> <li>• confidentiality requirements</li> <li>• ethical standards</li> <li>• fees and payment schedule</li> <li>• grievance and appeals processes</li> <li>• learner selection, enrolment, induction and orientation procedures</li> <li>• mutual recognition obligations</li> <li>• policies and procedures being available to all personnel, learners, clients and candidates</li> <li>• staff recruitment, induction and ongoing development and monitoring</li> <li>• support services available</li> <li>• human resources policies and procedures and legal requirements including anti-discrimination, equal employment, OHS</li> <li>• administrative and records management systems, for example that relating to:               <ul style="list-style-type: none"> <li>• contract manager</li> <li>• document version control</li> <li>• maintenance, retention, archiving, retrieval, storage and security of training and assessment information and records</li> <li>• personnel responsible for analysing statistics and data to ensure organisation complies with relevant standards across all of its operations and training and assessment activities</li> <li>• privacy and access to training and assessment information and records</li> <li>• reporting and recording requirements and</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>arrangements</li> <li>• supervisors and managers</li> <li>• union and employee representatives</li> <li>• users of training information such as finance personnel, human resources personnel, employers</li> </ul>
<b>Resource requirements</b> may include:	<ul style="list-style-type: none"> <li>• additional staff</li> <li>• distribution costs</li> <li>• equipment</li> <li>• production costs</li> <li>• promotional costs</li> <li>• research and development</li> <li>• re-tooling</li> <li>• staff training</li> </ul>
<b>Reporting systems</b> for reporting results may include:	<ul style="list-style-type: none"> <li>• arrangements for the issuing of Australian Qualifications Framework (AQF) qualifications and Statements of Attainment</li> <li>• arrangements for recognising and recording current competencies</li> <li>• electronic student management system which complies with AVETMISS or other reporting or statistical collection requirements</li> <li>• internal organisational recording and reporting systems</li> <li>• record keeping policies and procedures</li> </ul>
<b>Reporting results</b> may include:	<ul style="list-style-type: none"> <li>• Australian Apprenticeship Centre forms and letters such as for incentives and completions</li> <li>• availability of all reports and records for audit and monitoring purposes</li> <li>• enrolment forms</li> <li>• financial reporting for funding and payments from funding body</li> <li>• OHS incident reporting systems</li> <li>• performance agreements</li> <li>• reporting for apprenticeship and traineeship program delivery</li> <li>• reporting for in-house or internal program delivery</li> <li>• Training Contract and RTO notifications</li> </ul>
<b>Reporting requirements</b> may include those specified in:	<ul style="list-style-type: none"> <li>• AQTF Standards for Registered Training Organisations</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• AVETMISS process documentation</li> <li>• organisational documentation</li> </ul>
<i>Reporting systems</i> to map learner progress against partnership outcomes may include:	<ul style="list-style-type: none"> <li>• electronic systems including those using business technology such as:               <ul style="list-style-type: none"> <li>• computers</li> <li>• hardware</li> <li>• software</li> <li>• telephone networks</li> </ul> </li> <li>• physical systems such as face-to-face and print communications</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Stakeholder Relations - Relationship Management
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## Co-requisite units

Co-requisite units		

## BSBRKG301A Control records

### Modification History

Not applicable.

### Unit Descriptor

This unit describes the work required to classify, register, and track records and information about records within a business or records system.

#### Linkages outside these National Competency Standards

ISO DIS 15489 - Draft International Standard on Records Management

**The work described in this unit is linked to the work described in the following unit(s):**

Previous Business Qualification(s)

Nil

The Same Business Qualification:

BSBRKG302A Undertake disposal

This unit represents a progression of skills described in other units. It is recommended, then, that the following units are achieved prior to the achievement of this unit:

BSBRKG303A Retrieve information from information

BSBRKG304A Maintain business records

Subsequent Business Qualification(s):

BSBRKG401A Review the status of a record

BSBRKG402A Provide information from and about the records

BSBRKG403A Set up a business or records system for a small office

BSBRKG501A Determine business or records system specifications

BSBRKG503A Develop and maintain a classification scheme

BSBRKG604A Determine security and access rules and procedures

This unit describes the work required to classify, register, and track records and information about records within a business or records system.

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BSBRKG501A Determine business or records system specifications

BSBRKG503A Develop and maintain a classification scheme

BSBRKG604A Determine security and access rules and procedures

**Application of the Unit**

Not applicable.

**Licensing/Regulatory Information**

Not applicable.

**Pre-Requisites**

Not applicable.

**Employability Skills Information**

Not applicable.

**Elements and Performance Criteria Pre-Content**

Not applicable.

**Elements and Performance Criteria****Elements and Performance Criteria****Element****Performance Criteria**

1 Identify records for capture

1.1 Incoming material is categorised for records



capture in accordance with organisational procedures

- 1.2 Activity documented by the record is identified from the elements of the record in accordance with organisational procedures
  - 1.3 Area or action officer to which the record needs to be forwarded is identified from elements of the record, or its content, and in accordance with organisational procedures
  - 1.4 Incoming material is assessed against organisational checklist for determining what material needs to be captured.
  - 1.5 Material which does not need to be registered is dealt with in accordance with organisational procedures
  - 1.6 Records on which action is complete are located, removed, or copied from the active business or records system, in accordance with organisational procedures
  - 1.7 Where required by organisation procedures, the format/media of the record is modified in accordance with organisation requirements and procedures
- 2 Classify record(s)
    - 2.1 The identified transaction/action/activity documented by the record is matched to the organisation's classification scheme
    - 2.2 The full classification and sentencing of the record is selected in accordance with the system's rules and organisational procedures
    - 2.3 The classified/sentenced record is linked to other records in the business or records system in accordance with the system's rules and organisational procedures
    - 2.4 Indexing points (cross reference terms) are selected for the record in accordance with the system's rules and organisational procedures
- 3 Register record(s)
    - 3.1 Unique identifier is selected for record in accordance with organisational procedures and

business or records system rules

- 3.2 Record is registered into business or records system with title, description, details of record creator, immediate location and any other control information to fulfil the system requirements in accordance with organisational procedures and business or records system rules
  - 3.3 Any physical dependencies or format of a record that will assist with its management over time are recorded in accordance with business or records system rules
  - 3.4 Access and security status are determined in accordance with organisational procedures and documented in accordance with business or records system rules
  - 3.5 Disposal class and status of the record is determined and recorded in accordance with the business or records system's rules, and organisational procedures and schedules
  - 3.6 Record is forwarded to its appropriate location, which is recorded, in accordance with the system rules and organisational procedures
  - 3.7 The items identified for immediate destruction are separated from the rest of the body of records
- 4 Track record(s)
- 4.1 Unique identifier of record to be located is determined from request or instructions
  - 4.2 Location of record is obtained from business or records system in accordance with system rules and organisational procedures
  - 4.3 History of record location is obtained from business or records system in accordance with system rules and organisational procedures
  - 4.4 Information about record is obtained from business or records system in accordance with system rules and organisational procedures
  - 4.5 Information about the record is updated and amended in accordance with organisational procedures

- 4.6 All transactions on the business or records system are completed within the designated timeframe
- 5 Audit records against predetermined criteria
  - 5.1 Records are located with action officer and in storage areas in accordance with supervisors instructions
  - 5.2 Records are audited against predetermined criteria in accordance with organisational procedures and quality program
  - 5.3 Any discrepancies found are noted, and reported, in accordance with organisational procedures

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the critical aspects, knowledge and skills to be demonstrated to confirm competence for this unit. This is an integral part of the assessment of competence and should be read in conjunction with the Range Statement.

### Critical Aspects of Evidence

#### Demonstrate ability to:

Understand the processes of capture, classification, registration and tracking the location of records

Identify activities documented by records and apply classifications schemes

Record metadata accurately

#### Underpinning Knowledge

At this level the learner must demonstrate some relevant theoretical knowledge.

Relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

Recordkeeping principles and processes

Concepts of, and reasons for, effective records and archives management

Knowledge and understanding of organisation's business, functions, structure, and culture

Organisation's policies, strategies and procedures, particularly those relating to records access and security

Organisational recordkeeping environments and culture including locations and nature of transactions

Organisation's recordkeeping and information (including classification) systems

### **Underpinning Skills**

Explaining and clarifying procedures

Understanding and interpreting instructions

Listening to, questioning, and clarifying information requests

Managing own activities within a timeframe

Records management system and operation including access and security for vital records

Systematic approach to work

Using judgement and discretion with confidential information

Working systematically with accuracy and attention to detail

Reading and comprehending/interpreting nature of record content

Interpreting retention and disposal schedules

Interpreting and applying relevant access and security rules and conditions

Accurately recording metadata

Writing reports where precise meaning is required

Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

### **Resource Implications**

The learner and trainer should have access to appropriate documentation and resources normally used in the workplace

### **Consistency of Performance**

In order to achieve consistency of performance, evidence should be collected over a set period of time which is sufficient to include dealings with an appropriate range and variety of situations

### **Context/s of Assessment**

Competency is demonstrated by performance of all stated criteria, including paying particular attention to the critical aspects and the knowledge and skills elaborated in the Evidence Guide, and within the scope as defined by the Range Statement

Assessment must take account of the endorsed assessment guidelines in the Business Services Training Package

Assessment of performance requirements in this unit should be undertaken in an actual workplace or simulated environment

Assessment should reinforce the integration of the key competencies and the business services common competencies for the particular AQF level. Refer to the Key Competency Levels at the end of this unit

## Key Competency Levels

**Collecting, analysing and organising information** (Level 1) - to register, track and record the record within the guidelines of the organisation

**Communicating ideas and information** (Level 1) - in documenting the location of records

**Planning and organising activities**(Level 1) - in planning the classification and registration activities

**Working with teams and others** -

**Using mathematical ideas and techniques** (Level 1) - in following a logical process to classify, register and track the records

**Solving problems** (Level 1) - presented by discrepancies between actual and nominal record locations

**Using technology** (Level 1) - to register and track the records within the organisation's systems

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

The Evidence Guide identifies the critical aspects, knowledge and skills to be demonstrated to confirm competence for this unit. This is an integral part of the assessment of competence and should be read in conjunction with the Range Statement.

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Reading and comprehending/interpreting nature of record content

Interpreting retention and disposal schedules

Interpreting and applying relevant access and security rules and conditions

Accurately recording metadata

Writing reports where precise meaning is required

Ability to relate to people from a range of social, cultural and ethnic backgrounds and physical and mental abilities

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**Solving problems** (Level 1) - presented by discrepancies between actual and nominal record locations

**Using technology** (Level 1) - to register and track the records within the organisation's systems

Please refer to the Assessment Guidelines for advice on how to use the Key Competencies

## Range Statement

The Range Statement provides advice to interpret the scope and context of this unit of competence, allowing for differences between enterprises and workplaces. It relates to the unit as a whole and facilitates holistic assessment.

The following variables may be present for this particular unit:

**Legislation, codes and national standards relevant to the workplace which may include:**

award and enterprise agreements and relevant industrial instruments

relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

relevant industry codes of practice

**Access status of records may be:**

confidential

high security (restricted)

open

**Appropriate level may be:**

item level

chronological group

series

business or records system

**Quality assurance audit may be of part of, or all of, an organisation**

**Operating environment may be:**

under supervision

a team effort

solo

**Record information to be updated may come from:**

supervisor  
user  
file transfer slips  
action officers  
results of quality assurance audit  
requests

**Record media may be:**

electronic  
paper-based  
microform  
graphic  
mainframe  
PC-based applications

**Records may be registered (captured) into:**

current business or records systems  
archival control systems  
business systems  
storage facilities systems

**Records may be subject to special access conditions, arising from agreement with records creator or depositor, privacy or confidentiality considerations****Standard reports prepared from the business or records system may include:**

statistics  
resubmits for following day  
over due action reports  
daily correspondence

**Storage may be:**

centralised or decentralised  
off-line or off-site  
in-house or out-sourced  
commercial storage service or government repository  
CD storage  
imaging systems  
microform



audio-visual/multimedia formats

**Storage environment may be:**

temperature controlled

dust free

air conditioned

fire secure

intrusion secure

**Location of record may be:**

on a server

on a remote drive

physical

digital

**Disposal actions may include:**

retention

destruction

conversion to other record formats

transfer

**Criteria for audit may include:**

location

unique identifier

content

titling

compliance with recordkeeping metadata standards / requirements

**Discrepancies may be reported to:**

colleague

supervisor

manager

**Form of reporting may be:**

written

oral

reconciliation statement

The Range Statement provides advice to interpret the scope and context of this unit of competence, allowing for differences between enterprises and workplaces. It relates to the unit as a whole and facilitates holistic assessment.

The following variables may be present for this particular unit:

**Legislation, codes and national standards relevant to the workplace which may include:**

award and enterprise agreements and relevant industrial instruments

relevant legislation from all levels of government that affects business operation, especially in regard to Occupational Health and Safety and environmental issues, equal opportunity, industrial relations and anti-discrimination

relevant industry codes of practice

**Access status of records may be:**

confidential

high security (restricted)

open

**Appropriate level may be:**

item level

chronological group

series

business or records system

**Quality assurance audit may be of part of, or all of, an organisation**

**Operating environment may be:**

under supervision

a team effort

solo

**Record information to be updated may come from:**

supervisor

user

file transfer slips

action officers

results of quality assurance audit

requests

**Record media may be:**

electronic

paper-based

microform

graphic

mainframe

PC-based applications

**Records may be registered (captured) into:**

current business or records systems

archival control systems

business systems

storage facilities systems

**Records may be subject to special access conditions, arising from agreement with records creator or depositor, privacy or confidentiality considerations**

**Standard reports prepared from the business or records system may include:**

statistics

resubmits for following day

over due action reports

daily correspondence

**Storage may be:**

centralised or decentralised

off-line or off-site

in-house or out-sourced

commercial storage service or government repository

CD storage

imaging systems

microform

audio-visual/multimedia formats

**Storage environment may be:**

temperature controlled

dust free

air conditioned

fire secure

intrusion secure

**Location of record may be:**

on a server

on a remote drive

physical

digital

**Disposal actions may include:**

retention

destruction

conversion to other record formats

transfer

**Criteria for audit may include:**

location

unique identifier

content

titling

compliance with recordkeeping metadata standards / requirements

**Discrepancies may be reported to:**

colleague

supervisor

manager

**Form of reporting may be:**

written

oral

reconciliation statement

**Unit Sector(s)**

Not applicable.

## BSBSMB403A Market the small business

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to develop and implement marketing strategies, and to monitor and improve market performance.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This work is undertaken by individuals who operate a small business.</p> <p>This unit is suitable for micro and small businesses or a department in a larger organisation.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Develop marketing strategies	<p>1.1. Analyse the business and its key products or services to determine the focus of marketing activities, in accordance with the objectives of the business plan</p> <p>1.2. Evaluate the customer base and target market for the small business as a basis for the <b><i>marketing objectives and strategies</i></b></p> <p>1.3. Determine marketing objectives and strategies that are ethically and culturally appropriate, in consultation with <b><i>relevant people</i></b> and in accordance with the business plan</p>
2. Determine a marketing mix for the business	<p>2.1. Balance product mix, volumes and pricing to optimise sales and profit</p> <p>2.2. Evaluate the costs and benefits of using different <b><i>distribution channels</i></b> and/or providing different <b><i>levels of customer service</i></b> and consider the results in determining the <b><i>marketing mix</i></b></p> <p>2.3. Determine promotional activities to suit the target market</p> <p>2.4. Consider customer needs and preferences in determining the marketing mix</p> <p>2.5. Determine the marketing mix according to market and business needs</p>
3. Implement marketing	<p>3.1. Brief persons involved in the marketing effort on their roles and responsibilities, to ensure the success</p>

ELEMENT	PERFORMANCE CRITERIA
strategies	<p>of marketing strategies</p> <p>3.2. Plan and implement <i>promotional activities</i>, in accordance with marketing objectives and budgetary requirements</p>
4. Monitor and improve marketing performance	<p>4.1. Monitor marketing activities and evaluate business performance according to the objectives and targets of the business plan</p> <p>4.2. Analyse <i>performance gaps</i> and take corrective action or set new targets</p> <p>4.3. Encourage all relevant people to propose ways to improve marketing performance</p> <p>4.4. Seek and analyse <i>customer reaction</i> to all aspects of the marketing mix, using culturally appropriate processes, to improve targeting and outcomes</p> <p>4.5. Conduct ongoing research of customer requirements to identify opportunities for change and improvement</p> <p>4.6. Monitor and investigate changes in the market for new opportunities to aid business development</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills to question, clarify and report
- literacy and numeracy skills to research information, to analyse data and to interpret market data.

#### Required knowledge

- industry market trends
- methods of analysing costs and benefits of marketing strategies
- methods of developing marketing objectives and marketing mix
- methods of monitoring customer satisfaction
- relevant market analysis and research
- relevant marketing concepts and methods.

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• developing a marketing strategy and choosing a marketing mix for the small business that are culturally appropriate and that complement the business plan</li> <li>• implementing and monitoring the marketing strategy/plan to optimise the chances of small business success</li> <li>• knowledge of relevant marketing concepts and methods.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to relevant documentation</li> <li>• candidate's individual circumstances and work in the context of running a small business, are the basis for assessment.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• portfolio of evidence including marketing strategy and monitoring of marketing performance</li> <li>• oral or written questioning to assess knowledge of industry market trends</li> <li>• review of analysis of performance gaps and corrective action taken or new targets set</li> <li>• review of promotional activities implemented.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBSMB404A Undertake small business planning.</li> </ul>



## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b><i>Marketing objectives and strategies</i></b> may include:	<ul style="list-style-type: none"> <li>• achieving lower costs of production and distribution than competitors</li> <li>• creating a very different product line or service so that the business becomes a class leader in the industry</li> <li>• distribution</li> <li>• pricing, presentation and display of products/services</li> <li>• product design and packaging</li> <li>• product range and mix</li> <li>• promotion and advertising</li> <li>• pursuing cost leadership and/or product differentiation within a specialist market segment</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• accountant or other specialist services</li> <li>• family members, work team members, sub-contractors, community members</li> <li>• franchise agency</li> <li>• financial backers, clients</li> <li>• owner/operator, partners, directors, shareholders</li> <li>• regulatory bodies</li> <li>• trade or industry associations</li> </ul>
<b><i>Distribution channels</i></b> may include:	<ul style="list-style-type: none"> <li>• dealer, re-seller, franchisee</li> <li>• distributor, delivery service, mail order, telesales</li> <li>• self-access, wholesale, retail</li> </ul>
<b><i>Levels of customer service</i></b> may include:	<ul style="list-style-type: none"> <li>• after sales service</li> <li>• one-on-one personal service</li> <li>• sales assistance for problems/queries only</li> </ul>
<b><i>Marketing mix</i></b> may include:	<ul style="list-style-type: none"> <li>• distribution</li> <li>• level of service</li> <li>• pricing</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• promotion</li> <li>• quality, range</li> <li>• safety features</li> <li>• technical features, design</li> </ul>
<i>Promotional activities</i> may include:	<ul style="list-style-type: none"> <li>• advertising in national, suburban or local newspapers</li> <li>• advertising on radio or television</li> <li>• canvassing</li> <li>• development of networks and strategic alliances</li> <li>• display posters</li> <li>• exhibitions, in-store promotions</li> <li>• involvement in community projects</li> <li>• mail drops</li> <li>• professional/industry journals</li> <li>• sponsorship</li> <li>• staff development programs to enhance customer service orientation</li> <li>• website</li> <li>• word of mouth, referral, testimonials</li> </ul>
<i>Performance gaps</i> may include:	<ul style="list-style-type: none"> <li>• over achievement of performance targets</li> <li>• under achievement of performance targets</li> </ul>
<i>Customer reaction</i> may be determined through:	<ul style="list-style-type: none"> <li>• customer meetings, focus groups</li> <li>• identification of new business opportunities</li> <li>• informal discussion</li> <li>• sales to contact ratio</li> <li>• survey/other feedback mechanisms</li> <li>• trend analysis</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Management and Leadership - Small and Micro Business
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## Co-requisite units

Co-requisite units		

## BSBSMB405B Monitor and manage small business operations

### Modification History

Release	Comments
Release 1	<p>This version first released with <i>BSB07 Business Training Package version 6.0</i></p> <p>Revised unit. Required knowledge and Range Statement changed to include environmentally sustainable practices</p> <p>Replaces BSBSMB405A Monitor and manage small business operations</p>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to operate a small business and to implement a business plan. The strategies involve monitoring, managing and reviewing operational procedures.

Specific legal requirements apply to the management of a small business.

### Application of the Unit

This work is undertaken by individuals who operate a small business.

The unit is suitable for existing micro and small businesses or a department in a larger organisation.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Element	Performance Criteria
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Develop <b>operational strategies and procedures</b>	<p>1.1 Develop an action plan to provide a clear and coherent direction, in accordance with the <b>business goals and objectives</b></p> <p>1.2 Identify <b>occupational health and safety (OHS) and environmental issues</b> and implement strategies to minimise risk factors</p> <p>1.3 Develop a <b>quality system</b> for the business in line with industry standards, compliance requirements and cultural criteria</p> <p>1.4 Develop performance measures and <b>operational targets</b> to conform with the business plan</p> <p>1.5 Develop strategies for innovation, including the utilisation of existing, new or emerging technologies, where practicable, to optimise business performance</p>
2. Implement operational strategies and procedures	<p>2.1 Implement systems and key performance indicators/targets to monitor business performance and customer satisfaction</p> <p>2.2 Implement systems to control stock, expenditure/cost, wastage/shrinkage and risks to health and safety in accordance with the business plan</p> <p>2.3 Maintain staffing requirements, where applicable, within budget to maximise productivity</p> <p>2.4 Carry out the provision of goods/services in accordance with established legal, ethical cultural and <b>technical standards</b></p> <p>2.5 Provide goods/services in accordance with time, cost and quality specifications, and customer requirements</p> <p>2.6 Apply quality procedures to address product/service and customer requirements</p>
3. Monitor business performance	<p>3.1 Regularly monitor/review the achievement of operational targets to ensure optimum business performance, in accordance</p>

	<p>with the business plan goals and objectives</p> <p>3.2 Review systems and structures, with a view to more effectively supporting business performance</p> <p>3.3 Investigate and analyse operating problems to establish causes and implement changes as required as part of the business quality system</p> <p>3.4 Amend operational policies and procedures to incorporate corrective action</p>
4. Review business operations	<p>4.1 Review and adjust business plan, as required, to maintain business viability, in accordance with business goals and objectives</p> <p>4.2 Clearly record proposed changes to aid future planning and evaluation</p> <p>4.3 Undertake ongoing research into new business opportunities and adjust business goals and objectives as new business opportunities arise</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- analytical skills to develop criteria and targets for the business plan
- communication skills to question, clarify and report
- literacy skills to interpret legal requirements, company policies and procedures
- numeracy skills to manage performance information and to control the finances
- technology skills to use relevant business equipment.

### Required knowledge

- methods for developing and maintaining networks
- methods for implementing operation and revenue control systems
- methods for monitoring performance and implementing improvements
- OHS responsibilities and procedures for managing hazards
- principles of risk management relevant to the business, including risk assessment
- quality system principles and methods
- relevant industry codes of practice
- relevant marketing, sales and financial concepts
- relevant performance measures

- role of innovation
- systems to manage staff, stock, expenditure, services and customer service
- environmentally sustainable business practice and operation
- technical or specialist skills relevant to the business operation.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• developing strategies and procedures to successfully manage the operation of the business</li> <li>• making appropriate adjustments to the business operations as required</li> <li>• knowledge of quality system principles and methods.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to relevant documentation</li> <li>• candidate's individual circumstances and work in the context of running a small business, are the basis for assessment.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• portfolio of evidence including operational strategies and procedures</li> <li>• oral or written questioning to assess knowledge of principles of risk management relevant to the business, including risk assessment</li> <li>• review of analysis of operating problems (establishing causes and implementing changes as required as part of the business quality system)</li> <li>• review of records proposing changes to the business operations.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBSMB406A Manage small business finances</li> </ul>

	<ul style="list-style-type: none"> <li>• BSBSMB407A Manage a small team.</li> </ul>
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## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Operational strategies and procedures</i></b> may be determined by:	<ul style="list-style-type: none"> <li>• business premises (size, location, layout)</li> <li>• financial control systems and procedures</li> <li>• management and administrative systems and procedures</li> <li>• methods/techniques/technology</li> <li>• physical and natural resources</li> <li>• plant and equipment , including OHS requirements</li> <li>• premises, plant and equipment, which may be new or previously owned</li> <li>• purchase (sole or shared ownership) or leasing</li> <li>• raw materials</li> <li>• requirements, which may be one-off requirements or recurrent requirements (such as equipment maintenance) specific to the nature of the business</li> <li>• technology</li> <li>• environmentally sustainable principles of business operation</li> <li>• use of existing, new and emerging technologies including e-commerce.</li> </ul>
<b><i>Business goals and objectives</i></b> may include:	<ul style="list-style-type: none"> <li>• customer needs/marketing projections</li> <li>• family or community benefits</li> <li>• financial projections</li> <li>• goals, objectives, plans, systems and processes</li> <li>• lifestyle issues</li> <li>• proposed size and scale of the business, market focus of the business</li> <li>• short-, medium- or long-term goals</li> <li>• social responsibility.</li> </ul>
<b><i>Occupational health and safety and environmental issues</i></b> must include:	<ul style="list-style-type: none"> <li>• controls, which may include instructions to workplace personnel concerning site hazards and controls, material safety data sheets, use of personal protective equipment,</li> </ul>



	<p>vehicle access, signs and barricades, traffic control, outside contractors</p> <ul style="list-style-type: none"> <li>• establishment and maintenance of procedures for assessing and controlling risks</li> <li>• establishment and maintenance of procedures for identifying risks to health and safety</li> <li>• environmentally sustainable purchase and supply of goods and services</li> <li>• waste and by-products.</li> </ul>
<i>Quality system</i> may include:	<ul style="list-style-type: none"> <li>• manual or computer quality control systems</li> <li>• quality assurance/management approaches</li> <li>• random inspections and assessments of goods and services against predetermined standards</li> <li>• random inspections and assessments of processes against predetermined standards</li> <li>• random sampling and follow-up of customers.</li> </ul>
<i>Operational targets</i> may include:	<ul style="list-style-type: none"> <li>• external targets, which may relate to market share and positioning and may involve exploring new markets, building national or international trade links</li> <li>• internal targets, which may relate to size, quality, quantity and diversity, wages to sales, sales to area/stock levels/stock turnover/average debtor payment periods and levels</li> <li>• staffing level and skills mix</li> <li>• targets, which may be short-, medium- or long-term.</li> </ul>
<i>Technical standards</i> may include:	<ul style="list-style-type: none"> <li>• current and generally agreed descriptions of what the product/service is, how it should be produced/delivered and the environmental sustainability, quality, safety, efficiency or other measures to determine the activity is done effectively.</li> </ul>

## Unit Sector(s)

Management and Leadership – Small and Micro Business

## Custom Content Section

Not applicable.

## BSBSMB406A Manage small business finances

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to implement, monitor and review strategies for the ongoing management of a small business's finances. It also includes day to day financial management of the small business.</p> <p>Specific legal requirements apply to the management of a small business.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This work is undertaken by individuals who operate a small business.</p> <p>The unit is suitable for existing micro and small businesses or a department in a larger organisation.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Implement financial plan	<p>1.1. Identify <b><i>financial information</i></b> requirements and obtain <b><i>specialist services</i></b>, as required, to profitably operate and extend the business in accordance with the business plan</p> <p>1.2. Produce financial budgets/projections, including <b><i>cash flow</i></b> estimates, as required for each forward period, and distribute to <b><i>relevant people</i></b> in accordance with legal requirements</p> <p>1.3. Negotiate, secure and manage business capital to best enable implementation of the business plan and to meet the requirements of <b><i>financial backers</i></b></p> <p>1.4. Develop and maintain strategies to enable adequate financial provision for taxation in accordance with legal requirements</p> <p>1.5. Develop, monitor and maintain client <b><i>credit policies</i></b>, including contingencies for debtors in default, to maximise cash flow</p> <p>1.6. Select key performance indicators to enable ongoing monitoring of financial performance</p> <p>1.7. Record and communicate financial procedures to relevant people to facilitate implementation of the business plan</p>
2. Monitor financial performance	2.1. Regularly monitor and report on financial performance targets and analyse data to establish the

ELEMENT	PERFORMANCE CRITERIA
	<p>extent to which the <i>financial plan</i> has been met</p> <p>2.2. Monitor marketing and operational strategies for their effects on the financial plan</p> <p>2.3. Calculate and evaluate <i>financial ratios</i> according to own/industry benchmarks</p> <p>2.4. Assess financial plan to determine whether variations or alternative plans are needed, and change as required</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- analytical skills to interpret financial data
- communication skills to negotiate capital and to report on performance
- literacy skills to interpret legal requirements and financial reports
- numeracy skills to calculate costs, prices, profit and other financial information.

#### Required knowledge

The following knowledge must be assessed as part of this unit:

- benchmarking
- financial decision making relevant to the business
- financial indicators
- purpose of financial reports
- preparation and interpretation of budget/actual reports
- principles for preparation of balance sheets and their interpretation
- principles for preparation of profit and loss statements and their interpretation
- stock records/stock control relevant to the business.

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• development, implementation and review of strategies for the ongoing management of finance</li> <li>• maintenance of day-to-day financial management of the business as well as implementation of broad financial strategies</li> <li>• knowledge of purpose of financial reports.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to relevant documentation</li> <li>• candidate's individual circumstances and work in the context of establishing or running a small business, are the basis for assessment.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• portfolio of evidence including financial reports</li> <li>• preparation and review of financial ratios</li> <li>• review of cash flow projections</li> <li>• analysis of development, monitoring and maintenance of client credit policies</li> <li>• oral or written questioning to assess knowledge of principles for preparation of balance sheets and their interpretation.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBSMB402A Plan small business finances</li> <li>• BSBSMB405A Monitor and manage small business operations.</li> </ul>

## Range Statement

<b>RANGE STATEMENT</b>
The range statement relates to the unit of competency as a whole. It allows for different

**RANGE STATEMENT**

work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Financial plan*** may include:

- analysis of sales by product/service, identifying where they were sold and to whom
- cash flow estimates for each forward period
- current financial state of the enterprise (or owner/operator)
- estimates of profit and loss projections for each forward period
- financial performance to date (if applicable)
- likely return on investment
- monthly, quarterly or annual returns
- non-recurrent assets calculations
- profit, turnover, capital and equity targets
- projected profit targets, pricing strategies, margins
- projections of likely financial results (budgeting)
- projections, which may vary depending on the importance of such information and the stage in the life of the business
- resources required to implement the proposed marketing and production strategies (staff, materials, plant and equipment)
- review of financial inputs required (sources and forms of finance)
- risks and measures to manage or minimise risks
- working, fixed, debt and equity capital
- working in conjunction with external consultants e.g. investment analysts, accountants, financiers

***Financial information*** may include:

- accrual of staff leave/entitlements
- asset management strategies which may include:
  - owning, leasing, sharing, syndicating
  - maintaining and deploying assets
- asset registers
- balance sheets
- bookkeeping/accounting/stock/job costing records
- business activity statements
- business capital
- cash book

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• cash flow forecasts</li> <li>• financial budgets</li> <li>• financial indicators, which may be short-, medium- and/or long-term</li> <li>• payroll records, superannuation entitlements</li> <li>• profit and loss statements</li> <li>• ratios for profitability, liquidity/efficiency/financial structure</li> <li>• risk management</li> <li>• statements/forecasts</li> <li>• taxation returns including goods and services tax</li> </ul>
<i>Specialist services</i> may include:	<ul style="list-style-type: none"> <li>• accountants</li> <li>• business brokers/business consultants</li> <li>• government agencies</li> <li>• industry/trade associations</li> <li>• lawyers and providers of legal advice</li> <li>• mentors</li> <li>• online gateways</li> <li>• providers of training in accounting software</li> </ul>
<i>Cash flow</i> may include:	<ul style="list-style-type: none"> <li>• anticipated payments</li> <li>• anticipated receipts</li> <li>• customer credit policy/debt recovery</li> <li>• taxation provisions</li> </ul>
<i>Relevant people</i> may include:	<ul style="list-style-type: none"> <li>• family members</li> <li>• financial backers</li> <li>• franchise agency</li> <li>• owner/operator</li> <li>• partners</li> <li>• regulatory bodies</li> <li>• trade or industry associations</li> </ul>
<i>Financial backers</i> may include:	<ul style="list-style-type: none"> <li>• financiers/banks/lending institutions</li> <li>• leasing and hire purchase financiers</li> <li>• providers of venture capital</li> <li>• shareholders/partners/owners/family/friends</li> </ul>
<i>Credit policies</i> may include:	<ul style="list-style-type: none"> <li>• collateral</li> <li>• credit limits</li> <li>• credit references</li> <li>• debt collection</li> <li>• payment options</li> <li>• proof of Indigenous identity</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• trading terms</li> </ul>
<i>Financial ratios</i> may include:	<ul style="list-style-type: none"> <li>• current ratio</li> <li>• days debtors outstanding</li> <li>• days stock on hand</li> <li>• expense percentages</li> <li>• gross profit percentage</li> <li>• liquid ratio</li> <li>• net profit percentage</li> <li>• proprietary/debt ratio</li> <li>• return on investment/return on total assets</li> <li>• staff productivity measures</li> <li>• stock turn rates</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Management and Leadership - Small and Micro Business
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## Co-requisite units

Co-requisite units		



## CPCCLDG3001A Licence to perform dogging

### Modification History

Not Applicable

### Unit Descriptor

**Unit descriptor** This unit specifies the outcomes required to perform slinging techniques, including the selection and inspection of lifting gear and/or the directing of the crane operator in the movement of the load when the load is out of view of the crane/ operator for licensing purposes.

### Application of the Unit

**Application of the unit** This unit covers the scope of work to demonstrate competency in the application of slinging techniques, selection and inspection of lifting gear and/or the directing of the crane/ operator in the movement of the load.

This unit is based upon the National Standard for Licensing Persons Performing High Risk Work.

This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.

### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

**Prerequisite units** Nil

## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan job.	<p>1.1. <i>Site information</i> is obtained and related to the task.</p> <p>1.2. <i>Hazard</i> s and potential hazards associated with the slinging and directing of loads are identified.</p> <p>1.3. <i>Hazard control measures</i> consistent with <i>appropriate standards</i> are identified to ensure the safety of personnel and equipment.</p> <p>1.4. The weight, dimensions and centre of gravity of the load are identified and assessed.</p> <p>1.5. Suitable lifting/slinging points on the load are identified.</p> <p>1.6. Appropriate <i>lifting equipment</i> needs are assessed.</p> <p>1.7. Appropriate <i>communication methods</i> are assessed with <i>crane/</i> operators and other <i>appropriate personnel</i>.</p> <p>1.8. Manufacturer's specifications/information is obtained for special loads where necessary.</p>
2. Select and inspect equipment.	<p>2.1. Lifting equipment appropriate to the task is selected.</p> <p>2.2. Lifting equipment is inspected for serviceability.</p> <p>2.3. Damaged or excessively worn lifting equipment is identified, labelled and rejected.</p>

**ELEMENT****PERFORMANCE CRITERIA**

	2.4. Appropriate communication methods for the crane/operator and appropriate personnel are selected.
	2.5. Appropriate <i>communication equipment</i> is selected and its serviceability is checked.
	2.6. Appropriate <i>personal protective equipment</i> (PPE) is selected and checked.
3. Prepare site and equipment.	3.1. Hazard prevention/control measures are applied consistent with appropriate standards to ensure the safety of personnel and equipment.
	3.2. Appropriate slinging method is selected.
	3.3. Lifting equipment is prepared and assembled where appropriate.
	3.4. Load destination is prepared.
4. Perform task.	4.1. Lifting equipment is attached and secured to the lifting hook using appropriate techniques.
	4.2. Lifting hook is positioned over the load centre of gravity.
	4.3. Lifting equipment is attached and secured to the load in an appropriate manner.
	4.4. Tag line is attached and secured where appropriate.
	4.5. Test lift is conducted to ensure security of load.
	4.6. Load is moved maintaining stability and control at all times.
	4.7. Appropriate communication methods and <i>communication signals</i> are applied to safely coordinate the load movement both within sight and out-of-sight of crane operator.
	4.8. The load is landed to ensure that it is stable and secure from movement.
	4.9. Lifting equipment is removed or disconnected from load and prepared for next task or storage.
5. Shut down job and clean up.	5.1. Unserviceable lifting equipment inspected and rejected.
	5.2. <i>Defective equipment</i> is isolated and tagged.
	5.3. Lifting equipment is stored in accordance with procedures and appropriate standards.
	5.4. Hazard prevention/control measures are removed where appropriate.
	5.5. Excess materials from the work area are removed (where applicable).

**ELEMENT****PERFORMANCE CRITERIA**

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5.6. Defects are reported and recorded according to procedures and appropriate action is taken.

## **Required Skills and Knowledge**

### **REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

#### **Required skills**

Required skills for this unit are:

- communication techniques in the workplace including whistles, hand signals and use of fixed channel two-way radios
- communication skills at a level sufficient to communicate with other site personnel
- calculate rated capacity of lifting equipment
- apply different methods for making temporary connections to loads using fibre and synthetic ropes
- ability to interpret rated capacity and working load limit tags
- hazard identification and control
- slinging techniques
- selection and inspection of lifting equipment
- directing crane operators in the moving of loads in a safe manner, using a slewing crane
- inspection and care of a wide range of lifting equipment to appropriate Australian Standards and/or manufacturer's specifications.

#### **Required knowledge**

Required knowledge for this unit is:

- appropriate mathematical procedures for estimation and measurement of loads
- basic knowledge of types of cranes and their functions
- Commonwealth, state or territory OHS legislation, standards and codes of practice relevant to the full range of techniques for undertaking dogging activities
- load stability and safety factors in line with manufacturer's specifications
- types of lifting equipment and slinging techniques for use, and their limitations and performance in a wide range of conditions (including but not limited to slings, beams, accessories, clamps, work-boxes, bins and pallets)
- understanding of the hierarchy of control.

## Evidence Guide

### EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

Successful assessment of this unit meets the competency requirement of the National Standard for licensing Persons Performing High Risk Work.

State/Territory OHS regulators have mandated the use of Assessment Instruments and Instructions for Assessment of this unit which have been endorsed by the national body responsible for OHS matters.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- comply with Commonwealth, state or territory OHS legislation, standards relevant to safe dogging and crane operations.
- communicate and work safely with others in the work area.
- apply Hazard prevention and control measures consistent with appropriate standards.
- apply to move loads in conjunction with cranes including, the reading of tags, slinging, loading, directing and landing loads with a slewing mobile crane with a telescopic boom and a winch, in and out of sight of the crane/operator, moving four loads of varying shapes, sizes and weights.
- use fibre and/or synthetic rope as tag lines, and connecting to loads using clove hitch, rolling hitch, bowline and single sheetbend.
- conduct pre and post operational checks of the lifting equipment.
- Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the national OHS endorsed Assessment Instrument
- Assessment of performance must be

#### Context of and specific resources for assessment

## EVIDENCE GUIDE

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undertaken either in the workplace or in a realistically simulated workplace setting

- Assessors must ensure that the assessment in the workplace is organised through a workplace supervisor to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace
- Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints
- Assessment is to comply with the requirements of any relevant Standards or operating procedures for dogging activities
- Applicants must have access to:
  - personal protective equipment (PPE) for the purpose of the performance assessment.
  - four different loads as prescribed in the endorsed assessment instrument
  - lifting and associated equipment
  - suitable slewing crane
  - communication equipment (eg. fixed channel, two-way radios) as applicable.

### Method of assessment

Assessment must be conducted using the national OHS endorsed Assessment Instrument. This Instrument provides instruction on the application of the assessment.

Assessment may be in conjunction with the assessment of other units of competency.

The use of '**simulators**' in the assessment of this unit of competency is **not acceptable**.

Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.

Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.

### Guidance information for assessment

Further information about endorsed Assessment Instruments may be obtained from state/territory OHS regulators.

## Range Statement

### RANGE STATEMENT

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The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Site information may include but not be limited to***

- local conditions such as access and egress
- work method statements.

***Hazards*** may include but not limited to:

- ground stability (eg. ground condition, recently filled trenches, slopes)
- overhead hazards (e.g. power lines, service pipes, trees, buildings, etc)
- insufficient lighting
- traffic (e.g. pedestrians, vehicles, plant)
- weather (e.g. wind, lightning, storms)
- other specific hazards (e.g. trip hazards, heights, radio interference, etc).

***Hazard prevention/control measures***

The systematic process of eliminating or reducing the risk to personnel and property through the application of controls.

It includes the application of the hierarchy of controls, including:

1. elimination.
2. substitution.
3. isolation.
4. engineered control measures.
5. safe work practices.
6. personal protective equipment.

***Appropriate standard*** s may include:

- codes of practice
- legislation
- Australian Standards
- manufacturer's specifications
- industry standards.

## RANGE STATEMENT

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***Lifting Equipment*** may include but not limited to:

- fibre ropes
- wire ropes
- chain
- wire and synthetic slings
- shackles
- eyebolts
- beam clamps
- plate clamps
- spreader beams
- lifting beams
- pallet forks and cages
- concrete kibble
- personnel boxes.

***Communication Methods*** may include but are not limited to:

- written instructions
- signage,
- hand signals
- listening
- questioning to confirm understanding
- appropriate worksite protocol.

***Cranes*** may include but not limited to:

- tower cranes (including self erecting)
- portal boom cranes
- vehicle loading cranes
- slewing mobile cranes
- non-slewing cranes
- derrick cranes.

***Appropriate personnel*** may include but are not limited to:

- supervisors
- colleagues
- managers who are authorised to take responsibility for the workplace or operations.

***Communication Equipment*** may include but not limited to:

- fixed channel two-way radios
- whistles
- bells.

***Personal protective equipment (PPE)*** may include but not limited to:

- hard hat
- safety boots
- gloves
- high visibility clothing
- reflective vest
- relevant breathing, hearing, sight, skin and sun protection.

***Load destination*** may include but

- ground



## RANGE STATEMENT

not limited to:

- loading platforms
- suspended floors
- vehicles.

*Communication signals* may include but not limited to:

- stop - hand
- stop - whistle
- hoist up - hand
- hoist up - whistle
- hoist down - hand
- hoist down - whistle
- luff boom down - hand
- luff boom down - whistle
- luff boom up - hand
- luff boom up - whistle
- telescope out - hand
- telescope out - whistle
- telescope in - hand
- telescope in - whistle
- slew left - hand
- slew left - whistle
- slew right - hand
- slew right - whistle.

*Defective Equipment* may include but not limited to:

- excessive wear
- damage
- stretched
- broken wires
- cut/damaged fibres.

## Unit Sector(s)

Unit sector

Construction

## Co-requisite units

Co-requisite units

Nil

**Co-requisite units** Nil

## **Functional area**

**Functional area**

# CPCCLRG3001A Licence to perform rigging basic level

## Modification History

Not Applicable

## Unit Descriptor

**Unit descriptor** This unit specifies the outcomes required to perform basic rigging work associated with movement of plant and equipment, steel erections, hoists (including mast climbing hoists), placement of pre-cast concrete, safety nets and static lines, perimeter safety screens and shutters; and cantilever crane loading platforms for licensing purposes.

## Application of the Unit

**Application of the unit** This unit requires the applicant to be able plan the work, select and inspect equipment, set up task, erect structures and plant and dismantle structures and plant.

This unit is based upon the National Standard for Licensing Persons Performing High Risk Work.

This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.

This unit has a pre-requisite requirement. This requirement may be met by either the successful completion of the unit *CPCCLDG3001A Licence to perform dogging* or holding a valid licence for dogging.

## Licensing/Regulatory Information

Refer to Unit Descriptor

## Pre-Requisites

### Prerequisite units

CPCCLDG3001A

Licence to perform dogging

## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

### ELEMENT

### PERFORMANCE CRITERIA

- | ELEMENT      | PERFORMANCE CRITERIA   |
|--------------|--|
| 1. Plan job. | <p>1.1.Task to be undertaken is assessed.</p> <p>1.2.Potential workplace <i>hazards</i> are identified.</p> <p>1.3.<i>Hazard control measures</i> are identified consistent with <i>appropriate standards</i> to ensure the safety of personnel and equipment.</p> <p>1.4.Site information is obtained.</p> <p>1.5.All <i>forces and loads</i> associated with erecting and dismantling <i>structures</i> and <i>associated plant</i> are considered in consultation with <i>appropriate personnel</i>.</p> <p>1.6.<i>Rigging equipment</i> and <i>associated equipment</i> are identified in consultation with appropriate personnel according to <i>procedures</i> and site information.</p> |

ELEMENT	PERFORMANCE CRITERIA
	1.7. <i>Safety equipment</i> is identified.
	1.8. Appropriate <b><i>communication methods</i></b> are identified with appropriate personnel.
2. Select and inspect equipment.	2.1. Rigging equipment and associated equipment are selected and inspected according to procedures and the appropriate standard.
	2.2. Safety equipment is selected and inspected according to procedures.
	2.3. All defective rigging equipment, associated equipment and safety equipment is isolated, reported and recorded according to procedures.
	2.4. <b><i>Communication equipment</i></b> is selected and inspected for serviceability (where applicable).
3. Set up task.	3.1. Appropriate <b><i>hazard prevention/control measures</i></b> are applied to the work area according to procedures.
	3.2. <b><i>Ground suitability</i></b> is inspected and checked (where appropriate).
	3.3. Site information is reviewed, interpreted and communicated to appropriate personnel and <b><i>appropriate personnel</i></b> .
	3.4. All forces and loads associated with erecting and dismantling structures and associated plant are determined in consultation with appropriate personnel.
	3.5. Safety equipment is fitted and worn correctly (where appropriate).
	3.6. Rigging equipment and associated plant are positioned for work application and stability according to procedures.
	3.7. Methods of applying <b><i>temporary connections</i></b> using fibre rope are applied according to procedures and the appropriate standard.
4. Erect structures and plant.	4.1. Structures and associated plant are erected according to procedures and site information.
	4.2. Stability of structures and associated plant is maintained during erection according to procedures.
	4.3. Work is conducted safely at heights including safe and effective use of safety equipment.
	4.4. Appropriate communication methods and communication equipment, are used to co-ordinate the tasks.
	4.5. Associated plant and rigging equipment is used

**ELEMENT****PERFORMANCE CRITERIA**

	according to procedures and the appropriate standard.
	4.6. Temporary guys, ties, propping and shoring, including <i>flexible steel wire rope</i> , and tubing, are connected where required.
	4.7. Associated equipment is used in a safe and appropriate manner.
	4.8. The completed task is inspected according to the appropriate standard.
	4.9. Excess materials are removed from the work area (where applicable).
5. Dismantle structures and plant.	5.1. Structures and associated plant are dismantled according to procedures and the appropriate standard.
	5.2. Work is conducted safely at heights including safe and effective use of safety equipment.
	5.3. Stability of structures and associated plant is maintained during dismantling according to procedures.
	5.4. Rigging equipment, associated equipment, safety equipment and associated plant are inspected for damage and defects.
	5.5. All defective rigging equipment, associated equipment, associated plant and safety equipment are isolated reported and recorded according to procedures.
	5.6. Rigging equipment and associated equipment are stored. according to procedures and the appropriate standard.
	5.7. Hazard prevention/control measures are removed (where appropriate).

**Required Skills and Knowledge****REQUIRED SKILLS AND KNOWLEDGE**

This section describes the skills and knowledge required for this unit.

**Required skills**

## REQUIRED SKILLS AND KNOWLEDGE

Required skills for this unit are:

- ability to calculate Safe Working Load (SWL) and Working Load Limit (WLL)
- ability to erect and dismantle, level, plumb and stabilise associated plant and structures
- ability to work safely at heights including the correct application of safety equipment.
- accurate interpretation of basic structural charts and structural plans (site information)
- applying methods for making temporary connections of ropes using fibre and synthetic types
- apply methods of splicing and whipping fibre and synthetic ropes
- correct application and use of all rigging and associated equipment
- risk assessment and hazard control strategies
- interpersonal and communication skills at a level sufficient to site/workplace requirements. This includes the relevant communication methods and equipment.
- verify problems and equipment faults and demonstrate appropriate response.

### Required knowledge

Required knowledge for this unit is:

- appropriate mathematical procedures for estimation and measurement of loads
- ability to interpret manufacturer's specifications for all plant and equipment use in rigging operations
- knowledge of principles relating to all plant, equipment and structural stability
- knowledge of the types and functions of rigging, safety and associated equipment including an understanding of their limitations.
- organisational and workplace standards, requirements, policies and procedures for rigging
- understanding of the hierarchy of hazard identification and control
- relevant Commonwealth, state or territory and local government OHS legislation, standards and codes of practice for undertaking rigging activities
- understanding of inspection and maintenance requirements of a wide range of appropriate plant and equipment in line with Australian Standards or manufacturer's specifications
- estimation of ground bearing pressures of the full range of soil types and associated ground conditions for setting up plant and equipment.

# Evidence Guide

## EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

Successful assessment of this unit meets the competency requirement of the National Standard for licensing Persons Performing High Risk Work.

State/Territory OHS regulators have mandated the use of Assessment Instruments and Instructions for Assessment endorsed by the national body responsible for OHS matters for the assessment of this unit.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- comply with OHS licensing legislation.
- effectively communicate and work safely with others in the work area.
- effectively conduct risk assessment and management procedures.
- effectively complete the following tasks:-
  - inspection of all plant and equipment, and
  - installation of a fall arrest system (Static line), and
  - use of a safety harness / fall arrest system, and
  - installation of crane loading platforms and
  - installation of a safety net, and
  - installation of a shutter and safety screen, and
  - demonstrated ability to work safely at heights, and
  - erection of structural steel, and
  - erection of precast panel, and
  - set up and operation of a winch for load movement, and
  - installation of a materials hoist, or
  - installation of a mast climber.
- effectively demonstrate the following knots,



## EVIDENCE GUIDE

	<p>bends and hitches:-</p> <ul style="list-style-type: none"> <li>• Sheet bend,</li> <li>• Becket hitch,</li> <li>• Running bowline,</li> <li>• Double bowline.</li> </ul> <ul style="list-style-type: none"> <li>• effectively demonstrate the following splices and whippings:-             <ul style="list-style-type: none"> <li>• Eye splice,</li> <li>• Back splice,</li> <li>• Short splice,</li> <li>• Sail makers whipping,</li> <li>• Common whipping,</li> <li>• West countryman's</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the National OHS endorsed Assessment Instrument.</p> <p>Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</p> <p>Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</p> <p>Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</p> <p>Assessment is to comply with the requirements of any relevant Standards or operating procedures for basic rigging.</p> <p>Applicants must have access to:</p> <ul style="list-style-type: none"> <li>• personal protective equipment (PPE) for the purpose of the Performance Assessment.</li> <li>• appropriate safety equipment in safe condition</li> <li>• appropriate rigging equipment, associated equipment associated plant in safe condition as described in the endorsed assessment instrument</li> <li>• communication equipment (e.g. two-way</li> </ul>

## EVIDENCE GUIDE

	<p>radios) where applicable</p> <ul style="list-style-type: none"> <li>• appropriate materials as required for safe erection of structures</li> <li>• appropriate materials for conducting fibre rope slicing, whipping, knots, bends and hitches.</li> </ul>
<b>Method of assessment</b>	<p>Assessment must be conducted using the national OHS endorsed Assessment Instruments. These Instruments provide advice on their application.</p> <p>The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</p> <p>Assessment may be in conjunction with the assessment of other units of competency.</p> <p>Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</p> <p>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</p>
<b>Guidance information for assessment</b>	<p>Further information about endorsed Assessment Instruments may be obtained from state/territory OHS regulators.</p>

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Hazards** may include but are not limited to:

- ground stability (e.g. ground condition, recently filled trenches, slopes)
- overhead hazards (e.g. power lines, service pipes) (**NB:** minimum clearance distance from powerlines or electrical equipment as determined by relevant state authority or

## RANGE STATEMENT

	<p>electrical supply authority.)</p> <ul style="list-style-type: none"> <li>• traffic (e.g. pedestrians, vehicles, other plant)</li> <li>• insufficient lighting</li> <li>• environmental conditions (e.g. wind, lightning, storms)</li> <li>• other specific hazards (e.g. dangerous materials).</li> </ul>
<b><i>Hazard control measures:</i></b>	<p>Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <ul style="list-style-type: none"> <li>• elimination</li> <li>• substitution</li> <li>• isolation</li> <li>• engineering control measures</li> <li>• using safe work practices</li> <li>• personal protective equipment.</li> </ul>
<b><i>Appropriate standards</i></b> may include:	<ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian Standards</li> <li>• manufacturer's specifications</li> <li>• industry standards (where applicable).</li> </ul>
<b><i>Site Information</i></b> may include, but not limited to:	<ul style="list-style-type: none"> <li>• local conditions such as access and egress,</li> <li>• work method statements,</li> <li>• site specific job safety analyses and other site specific documentation as required.</li> <li>• task plans / Schedules and structural plans.</li> </ul>
<b><i>Forces and Loads</i></b> may include, but not limited to:	<ul style="list-style-type: none"> <li>• dead loads</li> <li>• live loads</li> <li>• static load</li> <li>• dynamic loads</li> <li>• wind loads.</li> </ul>
<b><i>Structures</i></b> may include but are not limited to:	<ul style="list-style-type: none"> <li>• structural steel</li> <li>• precast panels.</li> </ul>
<b><i>Associated plant</i></b> may include but not limited to:	<ul style="list-style-type: none"> <li>• static lines</li> <li>• safety nets</li> <li>• hoists</li> </ul>

## RANGE STATEMENT

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***Appropriate personnel*** may include:

- mast climbers
- loading platforms.
- engineers
- supervisors
- colleagues
- managers who are authorised to take responsibility for the workplace or operations.

***Rigging Equipment*** may include but is not limited to:

- scaffolds
- elevated work platforms
- personnel box
- cantilevered crane loading platforms
- mast climbers.
- safety screens and shutters
- cranes including but not limited to:
  - non-slewing cranes
  - mobile slewing cranes
  - vehicle loading cranes
  - tower cranes
  - self-erecting tower cranes
  - portal boom cranes
  - derrick cranes
  - bridge and gantry cranes.

***Associated equipment*** may include but is not limited to:

- all types of power and manually operated lifting gear
- fibre ropes
- flexible steel wire rope (FSWR)
- chains
- wire and synthetic slings
- shackles
- terminations
- wedge sockets
- eye bolts
- beam clamps
- plate clamps
- rope grips
- turnbuckles
- rigging screws
- chain blocks
- lever blocks
- lever-action winches

## RANGE STATEMENT

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	<ul style="list-style-type: none"> <li>• sheaves</li> <li>• spreader bars</li> <li>• lifting beams</li> <li>• jacks</li> <li>• levers</li> <li>• skates</li> <li>• wedges</li> <li>• rollers</li> <li>• girder trolley</li> </ul>
<b>Procedures</b> may include but is not limited to:	<ul style="list-style-type: none"> <li>• manufacturer's guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures, relevant codes of practice</li> <li>• workplace procedures (work instructions, operating procedures, checklists).</li> </ul>
<b>Safety Equipment</b> may include but not limited to:	<ul style="list-style-type: none"> <li>• safety harness</li> <li>• energy absorber</li> <li>• lanyard</li> <li>• inertia reel</li> <li>• static safety lines</li> <li>• safety nets.</li> </ul>
<b>Communication Methods</b> may include but is not limited to:	<ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening,</li> <li>• questioning to confirm understanding, and appropriate worksite protocol.</li> </ul> <p><b>NB:</b> Mobile phones are not to be used for signalling purposes during the rigging process.</p>
<b>Communication equipment</b> may include but is not limited to:	<ul style="list-style-type: none"> <li>• fixed channel two-way radios</li> </ul>
<b>Hazard prevention/control measures</b> may include but is not limited to:	<ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• powerlines are insulated</li> <li>• safety observer used inside exclusion zone</li> <li>• power disconnected</li> <li>• traffic barricades and control</li> <li>• pedestrian barricades</li> <li>• trench covers</li> </ul>

## RANGE STATEMENT

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	<ul style="list-style-type: none"> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> <li>• safety shutters and screens.</li> </ul>
<i>Ground suitability</i> may include but is not limited to:	<ul style="list-style-type: none"> <li>• rough uneven ground</li> <li>• backfilled ground</li> <li>• soft soils</li> <li>• hard compacted soil</li> <li>• rock</li> <li>• bitumen</li> <li>• concrete</li> <li>• suspended concrete floors</li> <li>• building roofs</li> <li>• landings</li> <li>• ground bearing pressure.</li> </ul>
<i>Appropriate personnel</i> may include but not limited to	<ul style="list-style-type: none"> <li>• other riggers</li> <li>• doggers</li> <li>• crane operators.</li> </ul>
<i>Temporary connections</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• knots</li> <li>• bends</li> <li>• hitches</li> <li>• spicing</li> <li>• whipping.</li> </ul>
<i>Flexible Steel Wire Rope (FSWR)</i> includes:	<ul style="list-style-type: none"> <li>• identification, uses and connections.</li> </ul>
	May include termination for:
	<ul style="list-style-type: none"> <li>• static lines,</li> <li>• guys,</li> <li>• purchase systems,</li> <li>• lashing,</li> <li>• cranes,</li> <li>• hoist and winch ropes.</li> </ul>

## Unit Sector(s)

**Unit sector**                      Construction

## **Co-requisite units**

**Co-requisite units** Nil

## **Functional area**

**Functional area**

## CPCCLSF2001A Licence to erect, alter and dismantle scaffolding basic level

### Modification History

Not Applicable

### Unit Descriptor

**Unit descriptor** This unit specifies the outcomes required to erect, alter and dismantle scaffolding at the basic level, consisting of scaffolding work connected with the operation or use of modular or pre-fabricated scaffolds, cantilevered materials hoists with a maximum working load of 500kg, ropes and gin wheels, safety nets and static lines, and bracket scaffolds (tank and formwork) for licensing purposes.

### Application of the Unit

**Application of the unit** This unit covers the scope of work to plan the job, select and inspect equipment, set up task, erect scaffold and scaffold equipment and dismantle scaffold and scaffold equipment.

This unit is based upon the National Standard for Licensing Persons Performing High Risk Work.

This unit in its current form it state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.

### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

**Prerequisite units** Nil



**Prerequisite units** Nil

## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

<p>Elements describe the essential outcomes of a unit of competency.</p>	<p>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</p>
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan job.	<p>1.1.Task to be undertaken is assessed.</p> <p>1.2.Potential workplace <b><i>hazards</i></b> are identified.</p> <p>1.3.<b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment.</p> <p>1.4.Site information is obtained.</p> <p>1.5.<b><i>Scaffold, associated equipment and scaffolding equipment</i></b> are identified from site information and in consultation with <b><i>appropriate personnel</i></b> (where applicable).</p> <p>1.6.<b><i>Safety equipment</i></b> is identified.</p> <p>1.7.All <b><i>forces and loads</i></b> exerted on and by the scaffold and/or scaffolding equipment are determined and calculated.</p> <p>1.8.Appropriate <b><i>communication methods</i></b> are identified with appropriate personnel.</p>

ELEMENT	PERFORMANCE CRITERIA
2. Select and inspect plant and equipment.	<p>2.1.Scaffold, associated equipment and scaffold equipment are selected and inspected according to <b>procedures</b> and site information.</p> <p>2.2.Safety equipment is selected and inspected according to procedures.</p> <p>2.3.All defective Scaffold, associated equipment, scaffold equipment and safety equipment are isolated according to procedures.</p> <p>2.4.All defective Scaffold, associated equipment, scaffold equipment and safety equipment are reported and recorded according to procedures.</p> <p>2.5.<b>Communication equipment</b> is selected and inspected for serviceability (where applicable).</p>
3. Set up task	<p>3.1.Appropriate <b>hazard prevention/control measures</b> are applied to the work area according to procedures.</p> <p>3.2.Ground suitability is checked.</p> <p>3.3.Appropriate footings are prepared to support scaffold and scaffold equipment according to procedures and the appropriate standard.</p> <p>3.4.Scaffold and scaffold equipment are prepared for erection according to procedures and the appropriate standard.</p> <p>3.5.Safety equipment is fitted and secured according to procedures (where applicable).</p> <p>3.6.Scaffold and scaffold equipment are positioned for work application and <b>stability</b> according to procedures and the appropriate standard.</p>
4. Erect scaffold and scaffold equipment.	<p>4.1.Scaffold and scaffold equipment are erected according to procedures and the appropriate standard.</p> <p>4.2.Work is conducted safely at heights including safe and effective use of safety equipment.</p> <p>4.3.Scaffold and scaffold equipment are erected consistent with site information.</p> <p>4.4.Appropriate communication methods are used to coordinate the tasks.</p> <p>4.5.Completed tasks are inspected for compliance with the appropriate standard.</p> <p>4.6.Handover certificate is completed as required and handed to appropriate personnel.</p> <p>4.7.Excess materials from the work area are removed (where applicable).</p>

ELEMENT	PERFORMANCE CRITERIA
5. Dismantle scaffold and scaffold equipment.	<p>5.1.Scaffold and scaffold equipment are dismantled according to procedures and the appropriate standard.</p> <p>5.2.Work is conducted safely at heights including safe and effective use of safety equipment.</p> <p>5.3.Scaffold, associated equipment and scaffold equipment are inspected for damage and defects.</p> <p>5.4.All damaged and defective scaffold, associated equipment and scaffold equipment are tagged and isolated according to procedures.</p> <p>5.5.Hazard prevention/control measures are removed (where appropriate).</p> <p>5.6.All damaged and defective scaffold, associated equipment and scaffold equipment are reported and recorded according to procedures and appropriate action taken.</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills for this unit are:

- ability to calculate Safe Working Load (SWL) and Working Load Limit (WLL)
- ability to erect scaffold within the scope of the basic scaffolder
- ability to erect, level, plumb and stabilise cantilever hoists and scaffolds
- ability to interpret manufacturer's specifications for plant and equipment
- ability to work safely at heights
- ability to set up fall arrest systems, including safety nets
- ability to work safely in confined spaces
- accurate interpretation of basic structural charts and structural plans
- applying methods for making temporary connection using fibre ropes
- correct application of all scaffolding equipment
- methods for making temporary connection of guy ropes and static lines using Flexible Steel Wire Rope (FSWR)
- verify problems and equipment faults and demonstrate appropriate response.

## REQUIRED SKILLS AND KNOWLEDGE

### Required knowledge

Required knowledge for this unit is:

- use of appropriate mathematical procedures for estimation and measurement of loads Commonwealth, state or territory OHS legislation and local government regulations, including standards and codes of practice relevant to the full range of techniques for undertaking basic scaffolding activities
- knowledge of principles relating to plant and equipment stability
- knowledge of types of scaffolding and their application
- knowledge of scaffolding erection and dismantling techniques
- knowledge of types of hoists, plant and equipment associated with basic scaffolding and their use/s
- risk assessment and control, including understanding of the hierarchy of control
- estimation of bearing pressures of the full range of soil types and associated ground conditions for setting up plant and equipment
- load capabilities of different types of scaffolding constructions
- understanding and application of organisational and workplace standards, requirements, policies and procedures for scaffolding
- safety equipment applicable to scaffolding
- understanding and application of the inspection and maintenance requirements for basic scaffold, associated equipment and scaffold equipment
- uses and limitations of tools and equipment, appropriate to scaffolding tasks and activities.

## Evidence Guide

### EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

Successful assessment of this unit meets the competency requirement of the National Standard for licensing Persons Performing High Risk Work.

State/Territory OHS regulators have mandated the use of Assessment Instruments and Instructions for Assessment endorsed by the national body responsible for OHS matters for the assessment of

## EVIDENCE GUIDE

	this unit.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• comply with OHS licensing requirements.</li> <li>• effectively communicate and work safely with others in the work area.</li> <li>• effectively apply risk assessment and hazard management procedures at a basic scaffolder level.</li> <li>• effectively complete the planning, erection and dismantling of a scaffolding system, in accordance with procedures, including a minimum of erect and dismantle:             <ul style="list-style-type: none"> <li>• Modular Scaffold with return and ladder access and platform brackets (hop-up brackets)</li> <li>• Bracket Scaffold</li> <li>• Mobile Scaffold</li> <li>• gin wheel</li> <li>• Cantilever Hoist</li> <li>• safety net and static line</li> <li>• safety screen</li> </ul> </li> </ul> <p>Scaffold to be of a minimum height of at least 5.0 metres above the supporting surface with full edge protection (includes safety screen) for each work platform including toe boards and handrails.</p> <ul style="list-style-type: none"> <li>• correctly demonstrate fibre rope bends and hitches.</li> <li>• effectively conduct pre and post operational checks of basic scaffolding.</li> <li>• complete handover certificate as required.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the National OHS endorsed Assessment Instrument</li> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting</li> <li>• .Assessors must ensure that the assessment in</li> </ul>

## EVIDENCE GUIDE

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the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace

- Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints for basic scaffolding
- Applicants must have access to:
  - personal protective equipment (PPE) for the purpose of the Performance Assessment
  - appropriate safety equipment in safe condition
  - appropriate scaffolding and associated scaffolding equipment
  - communication equipment (e.g. fixed channel two way radios) where applicable
  - appropriate personnel to assist with the erecting and dismantling of scaffold and scaffold equipment.

### Method of assessment

Assessment must be conducted using the national OHS endorsed Assessment Instruments. These Instruments provide advice on their application.

Assessment may be in conjunction with the assessment of other units of competency.

The use of '**simulators**' in the assessment of this unit of competency is **not acceptable**.

Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.

Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.

### Guidance information for assessment

Further information about endorsed Assessment Instruments may be obtained from state/territory OHS regulators.

## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Hazards*** may include but not limited to:

- ground conditions (e.g. ground bearing pressure/s, back filled trenches, underground services, slopes)
- overhead hazards (e.g. power lines, service pipes) (minimum clearance distance from powerlines or electrical equipment as determined by relevant state authority or electrical supply authority)
- traffic (e.g. pedestrians, vehicles, other plant)
- insufficient lighting
- environmental conditions (e.g. wind, lightning, storms)
- other site specific hazards (e.g. hazardous materials).

***Hazard control measures:***

Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.

It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:

- elimination
- substitution
- isolation
- engineering control measures
- using safe work practices
- personal protective equipment.
- codes of practice
- legislation
- Australian Standards
- manufacturer's specifications
- industry standards (where applicable).
- local conditions such as access and egress
- work method statements

***Appropriate standards*** may include:

***Site Information*** may include, but not be limited to:

## RANGE STATEMENT

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*Scaffold* may include but not limited to:

- site-specific job safety analyses and other documentation as required
- task plans.
- mobile scaffolding
- bracket scaffolding
- modular scaffolding, including:
  - steel
  - fibreglass and
  - aluminium frame scaffolding
- prefabricated scaffolding.
- planks
- flexible steel wire rope and fittings.

*Associated equipment* may include but not limited to:

**NB:** including identification, uses and connections which may include termination for static lines and guys for cantilever hoists.

- ladders
- tie tubes and fittings
- fibre rope

**NB:** including identification and uses (natural and synthetic), and connections associated with bends and hitches.

- stairways and screening
- hand tools, including, but not limited to:
  - box spanners
  - hammers
  - spirit levels
  - tape measures
  - scaffold belts
  - podgers
  - hammers
  - wire nips
  - wrenches
  - torpedo levels
  - shovels
  - spanners
  - cutters
  - hammer drills
  - sledge hammers



## RANGE STATEMENT

***Scaffolding equipment*** may include but not limited to:

- wheel barrows and
- relevant maintenance equipment.

***Appropriate personnel*** may include, but are not limited to:

- materials hoists
- gin wheels
- safety nets
- static lines and fittings.
- supervisors
- colleagues
- managers who are authorised to take responsibility for the workplace or operations
- other scaffolders
- other site personnel as applicable.

***Safety equipment*** may include but not limited to:

- safety harness
- energy absorber
- lanyard
- inertia reel.

***Forces and Loads*** may include, but are not limited to:

- dead loads
- live loads
- static load
- dynamic loads
- wind loads.

***Communication Methods*** may include but not limited to:

- verbal and non-verbal language
- written instructions
- signage
- communication signals
- listening
- questioning to confirm understanding, and appropriate worksite protocol.

***Procedures*** may include but not limited to:

- manufacturer's guidelines (instructions, specifications or checklists)
- industry operating procedures, relevant codes of practice
- workplace procedures (work instructions, operating procedures, checklists)
- reporting and recording procedures such as e.g. equipment defect/s.

***Communication equipment*** may include but is not limited to:

- fixed frequency two way radios
- mobile phones.

***Hazard prevention/control measures*** may include but not

- safety tags on electrical switches/isolators
- safety observer used inside exclusion zone

## RANGE STATEMENT

limited to:	<p>(e.g. Spotter), to include the use of power line warning systems (e.g. Tiger tails)</p> <ul style="list-style-type: none"> <li>• power disconnected by competent authority where applicable</li> <li>• traffic and pedestrian barricades and controls</li> <li>• safe and adequate access / egress is established</li> <li>• personal protective equipment</li> <li>• adequate illumination.</li> </ul>
<i>Ground suitability</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• rough uneven ground</li> <li>• backfilled ground</li> <li>• soft soils</li> <li>• hard compacted soil</li> <li>• rock</li> <li>• bitumen</li> <li>• concrete.</li> </ul>
<i>Stability</i> may include but is not limited to:	<ul style="list-style-type: none"> <li>• ground bearing pressure</li> <li>• sole plates/boards</li> <li>• screw jacks</li> <li>• levelling</li> <li>• ties/guys.</li> </ul>

## Unit Sector(s)

Unit sector	Construction
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## Co-requisite units

Co-requisite units	Nil
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## Functional area

### Functional area

## CPCCLSF3001A Licence to erect, alter and dismantle scaffolding intermediate level

### Modification History

Not Applicable

### Unit Descriptor

**Unit descriptor** This unit specifies the outcomes required to erect, alter and dismantle scaffolding at the Intermediate level which includes use and operation of Cantilevered crane-loading platforms, Cantilevered and spurred scaffolds, Barrow ramps and sloping platforms, perimeter safety screens and shutters Mast climbers, and tube and coupler scaffolds (including tube and coupler covered ways and gantries) for licensing purposes.

### Application of the Unit

**Application of the unit** This unit covers the scope of work to plan the job, select and inspect equipment, set up task, erect scaffold and scaffold equipment and dismantle scaffold and scaffolding equipment.

This unit is based upon the National Standard for Licensing Persons Performing High Risk Work.

This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.

This unit has a pre-requisite requirement. This requirement may be met by either the successful completion of the unit *CPCCLSF2001A Licence to erect, alter and dismantle scaffolding basic level* or holding a valid licence for basic scaffolding.

## Licensing/Regulatory Information

Refer to Unit Descriptor

## Pre-Requisites

### Prerequisite units

CPCCLSF2001A	Licence to erect, alter and dismantle scaffolding basic level
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## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan job.	1.1.Task to be undertaken is assessed. 1.2.Potential workplace <b><i>hazards</i></b> are identified. 1.3. <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment. 1.4.Site information is obtained.

## ELEMENT

## PERFORMANCE CRITERIA

	<p>1.5. <i>Scaffold, associated equipment and scaffold equipment</i> are identified from site information and in consultation with appropriate <i>personnel</i> (where applicable).</p> <p>1.6. <i>Safety equipment</i> is identified.</p> <p>1.7. All <i>forces and loads</i> exerted on and by the scaffold and/or scaffolding equipment are determined and calculated.</p> <p>1.8. Appropriate <i>communication methods</i> are identified with appropriate personnel.</p>
2. Select and inspect equipment.	<p>2.1. Scaffold, associated equipment and scaffold equipment are selected and inspected according to <i>procedures</i> and site information.</p> <p>2.2. Safety equipment is selected and inspected according to procedures.</p> <p>2.3. All defective scaffold, associated equipment, scaffold equipment and safety equipment are isolated according to procedures.</p> <p>2.4. All defective scaffold, associated equipment, scaffold equipment and safety equipment are reported and recorded according to procedures.</p> <p>2.5. <i>Communication equipment</i> is selected and inspected for serviceability (where applicable).</p>
3. Set up task.	<p>3.1. Appropriate <i>hazard prevention/control measures</i> are applied to the work area according to procedures.</p> <p>3.2. Ground suitability is checked.</p> <p>3.3. Appropriate footings are prepared to support scaffold and scaffold equipment according to procedures and the appropriate standard.</p> <p>3.4. Scaffold and scaffold equipment are prepared for erection</p> <p>3.5. Fit safety equipment and secure according to procedures (where applicable).</p> <p>3.6. Scaffold and scaffold equipment are positioned for work application and <i>stability</i> according to procedures and the appropriate standard.</p>
4. Erect scaffold and scaffolding equipment.	<p>4.1. Scaffold and scaffold equipment are erected according to procedures and the appropriate standard.</p> <p>4.2. Work is conducted safely at heights including safe and effective use of safety equipment.</p> <p>4.3. Scaffold and scaffold equipment are erected</p>

ELEMENT	PERFORMANCE CRITERIA
5. Dismantle scaffold and scaffolding equipment.	consistent with site information.
	4.4. Appropriate communication methods are used to coordinate the tasks.
	4.5. Completed tasks are inspected for compliance with the appropriate standard.
	4.6. Handover certificate is completed as required and handed to appropriate personnel.
	4.7. Excess materials from the work area are removed (where applicable).
	5.1. Scaffold and scaffold equipment are dismantled according to procedures and the appropriate standard.
	5.2. Work is conducted safely at heights including safe and effective use of safety equipment.
	5.3. Scaffold, associated equipment and scaffold equipment are inspected for damage and defects.
	5.4. All damaged and defective scaffold, associated equipment and scaffold equipment are tagged and isolated according to procedures.
	5.5. Hazard prevention/control measures are removed (where appropriate).
	5.6. All damaged and defective scaffold, associated equipment and scaffold equipment are reported and recorded according to procedures and appropriate action taken.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills for this unit are:

- ability to erect scaffold and scaffolding equipment within the scope of the intermediate scaffolder
- ability to erect, level, plumb and stabilise scaffolds and scaffold equipment within the scope of the intermediate scaffolder
- ability to interpret manufacturer's specifications for plant and equipment

## REQUIRED SKILLS AND KNOWLEDGE

- ability to work safely at heights
- accurate interpretation of basic structural charts and structural plans
- correct application of all scaffolding equipment
- verify problems and equipment faults and demonstrate appropriate response.

### Required knowledge

Required knowledge for this unit is:

- use of appropriate mathematical procedures for estimation and measurement of loads
- Commonwealth, state or territory OHS legislation and local government regulations, including standards and codes of practice relevant to the full range of techniques for undertaking intermediate scaffolding activities
- knowledge of principles relating to plant and equipment stability
- knowledge of types of scaffolding and their application
- knowledge of scaffold and scaffold equipment erection and dismantling techniques
- knowledge of types of scaffold and scaffold equipment, associated with intermediate scaffolding and their use/s
- risk assessment and control, including understanding of the hierarchy of control
- load capabilities of different types of scaffolding constructions
- understanding and application of organisational and workplace standards, requirements, policies and procedures for scaffolding
- application of safety equipment applicable to scaffolding
- understanding and application of the inspection and maintenance requirements for intermediate scaffold, associated equipment and scaffold equipment
- uses and limitations of tools and equipment, appropriate to scaffolding tasks and activities.

## Evidence Guide

### EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

Successful assessment of this unit meets the competency requirement of the National Standard for licensing Persons Performing High Risk Work.

State/Territory OHS regulators have mandated the use of Assessment Instruments and Instructions for



## EVIDENCE GUIDE

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessment endorsed by the national body responsible for OHS matters for the assessment of this unit.

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- Effectively communicate and work safely with others in the work area.
- Effectively apply risk assessment and hazard management procedures at an intermediate scaffolder level.
- Effectively complete the planning, erection and dismantling of scaffolding systems, in accordance with procedures, including a minimum of erect and dismantle the following:
  - Cantilevered and spurred scaffolds
  - Barrow ramps and/ or sloping platforms
  - Tube and coupler scaffolds
  - Cantilevered crane-loading platforms
  - Mast climbers

Cantilevered, spurred and tube and coupler scaffolds to be of a minimum height of 5.0 metres above the supporting surface with full edge protection, for each work platform including toe boards and handrails.

- Apply safety screen to tube and coupler scaffold.
- Effectively conduct compliance inspections of scaffold and scaffold equipment for intermediate scaffolding.
- Complete handover certificate as required.
- Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the National OHS endorsed Assessment Instrument.
- Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.
- Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a

### Context of and specific resources for assessment

## EVIDENCE GUIDE

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suitable working area is made available to suit the assessment and the workplace.

- Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints for intermediate scaffolding.
- Applicants must have access to:
  - personal protective equipment (PPE) for the purpose of the Performance Assessment
  - appropriate safety equipment in safe condition
  - appropriate scaffold and scaffold equipment in safe condition
  - site information as described in the mandated assessment instrument
  - communication equipment (e.g. fixed channel two way radios) where applicable
  - appropriate personnel to assist with the erecting and dismantling of scaffold and scaffold equipment.

### Method of assessment

Assessment must be conducted using the national OHS endorsed Assessment Instruments. These Instruments provide advice on their application.

Assessment may be in conjunction with the assessment of other units of competency.

The use of '**simulators**' in the assessment of this unit of competency is **not acceptable**.

Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.

Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.

### Guidance information for assessment

Further information about endorsed assessment instruments may be obtained from state/territory OHS regulators.

## Range Statement

### RANGE STATEMENT

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The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***Hazards*** may include but not limited to:

- ground conditions (e.g. ground bearing pressure/s, back filled trenches, underground services, slopes)
- overhead hazards (e.g. power lines, service pipes) (minimum clearance distance from powerlines or electrical equipment as determined by relevant state authority or electrical supply authority.)
- traffic (e.g. pedestrians, vehicles, other plant)
- insufficient lighting
- environmental conditions (e.g. wind, lightning, storms)
- other site specific hazards (e.g. hazardous materials).

***Hazard control measures:***

Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls.

It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:

- elimination
- substitution
- isolation
- engineering control measures
- using safe work practices
- personal protective equipment.
- codes of practice
- legislation
- Australian Standards
- manufacturer's specifications
- industry standards (where applicable).

***Appropriate standards*** may include:

- local conditions such as access and egress
- work method statements

***Site Information*** may include, but not limited to:

## RANGE STATEMENT

<i>Scaffold</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• site-specific job safety analyses and other documentation as required</li> <li>• task plans.</li> <li>• all scaffolds at the basic level</li> <li>• cantilevered and spurred scaffolds</li> <li>• barrow ramps and sloping platforms</li> <li>• tube and coupler scaffolds (including tube and coupler covered ways and gantries)</li> <li>• cantilever loading platforms.</li> </ul>
<i>Associated equipment</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• all associated equipment from basic scaffolding level</li> <li>• independent adjustable props.</li> </ul>
<i>Scaffold equipment</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• all scaffold equipment at the basic level</li> <li>• mast climbers</li> <li>• screen and shutters.</li> </ul>
<i>Appropriate personnel</i> may include, but are not limited to:	<ul style="list-style-type: none"> <li>• supervisors</li> <li>• colleagues</li> <li>• managers who are authorised to take responsibility for the workplace or operations</li> <li>• other scaffolders</li> <li>• other site personnel as applicable.</li> </ul>
<i>Safety equipment</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• safety harness</li> <li>• energy absorber</li> <li>• lanyard</li> <li>• inertia reel.</li> </ul>
<i>Forces and Loads</i> may include, but are not limited to:	<ul style="list-style-type: none"> <li>• dead loads</li> <li>• live loads</li> <li>• static load</li> <li>• dynamic loads</li> <li>• wind loads.</li> </ul>
<i>Communication Methods</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• communication signals</li> <li>• listening</li> <li>• questioning to confirm understanding, and appropriate worksite protocol.</li> </ul>
<i>Procedures</i> may include but not limited to:	<ul style="list-style-type: none"> <li>• manufacturer's guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures, relevant codes</li> </ul>

## RANGE STATEMENT

	of practice
	<ul style="list-style-type: none"> <li>workplace procedures (work instructions, operating procedures, checklists)</li> <li>reporting and recording procedures such as e.g. scaffold and scaffold equipment defects.</li> </ul>
<i>Communication equipment</i> may include but not limited to:	<ul style="list-style-type: none"> <li>fixed frequency two way radios</li> <li>mobile phones.</li> </ul>
<i>Hazard prevention/control measures</i> may include but not limited to:	<ul style="list-style-type: none"> <li>safety tags on electrical switches/isolators</li> <li>safety observer used inside exclusion zone (e.g. Spotter), to include the use of power line warning systems (e.g. Tiger tails)</li> <li>power disconnected by competent authority where applicable.</li> <li>traffic and pedestrian barricades and controls</li> <li>safe and adequate access / egress is established</li> <li>personal protective equipment</li> <li>adequate illumination.</li> </ul>
<i>Ground suitability</i> may include but not limited to:	<ul style="list-style-type: none"> <li>rough uneven ground</li> <li>backfilled ground</li> <li>soft soils</li> <li>hard compacted soil</li> <li>rock</li> <li>bitumen</li> <li>concrete.</li> </ul>
<i>Stability</i> may include but not limited to:	<ul style="list-style-type: none"> <li>ground bearing pressure</li> <li>sole plates/boards</li> <li>screw jacks</li> <li>levelling</li> <li>ties/guys.</li> </ul>

## Unit Sector(s)

Unit sector                      Construction

## Co-requisite units

Co-requisite units Nil

## Functional area

Functional area

# CPCCOHS1001A Work safely in the construction industry

## Modification History

Not Applicable

## Unit Descriptor

**Unit descriptor** This unit of competency specifies the outcomes required to undertake Occupational Health and Safety (OHS) induction training within the construction industry.

It requires the ability to demonstrate personal awareness of OHS legislative requirements, and the basic principles of risk management and prevention of injury and illness in the construction industry.

Licensing requirements will apply to this unit of competency depending on the regulatory requirements of each jurisdiction.

## Application of the Unit

**Application of the unit** This unit of competency supports the attainment of the basic OHS knowledge required prior to undertaking designated work tasks within any of the sectors within the construction industry. The unit relates directly to the general induction training program specified by the *National Code of Practice for Induction for Construction Work* (ASCC 2007).

## Licensing/Regulatory Information

Refer to Unit Descriptor

## Pre-Requisites

**Prerequisite units** Nil

**Prerequisite units** Nil

## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

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Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify OHS legislative requirements.	1.1.Applicable <b><i>OHS legislative requirements</i></b> relevant to own work, role and responsibilities are identified and explained. 1.2.Duty of care requirements are identified. 1.3.Own responsibilities to comply with <b><i>safe work practices</i></b> are identified and explained.
2. Identify construction hazards and control measures.	2.1.Basic principles of risk management are identified. 2.2. <b><i>Common construction hazards</i></b> are identified and discussed. 2.3. <b><i>Measures for controlling</i></b> hazards and risks are identified.
3. Identify OHS communication and reporting processes.	3.1.OHS communication processes, information and documentation are identified and discussed. 3.2.Role of <b><i>designated OHS personnel</i></b> is identified and explained.



ELEMENT	PERFORMANCE CRITERIA
4. Identify OHS incident response procedures.	3.3. <i>Safety signs and symbols</i> are identified and explained.
	3.4. Procedures and <i>relevant authorities</i> for reporting hazards, <i>incidents</i> and injuries are identified.
	4.1. <i>General procedures</i> for responding to incidents and <i>emergencies</i> are identified and explained.
	4.2. Procedures for accessing first aid are identified.
	4.3. Requirements for the selection and use of relevant <i>personal protective equipment</i> are identified and demonstrated.
	4.4. <i>Fire safety equipment</i> is identified and discussed.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills for this unit are:

- communication skills to:
  - clarify OHS legislative requirements
  - verbally report construction hazards and risks
  - ask effective questions
  - relay information to others
  - discuss OHS issues and information
- comprehension skills to:
  - explain the basic OHS legislative requirements which will be applicable to own work
  - explain the meaning of safety signs and symbols
  - identify common construction hazards
  - discuss the basic principles of risk management.

#### Required knowledge

Required knowledge for this unit is:

- applicable Commonwealth, State or Territory OHS legislation, regulations, standards, codes of practice and industry standards/guidance notes relevant to own

## REQUIRED SKILLS AND KNOWLEDGE

work, role and responsibilities

- basic principles of risk management and assessment for construction work
- common construction hazards
- common construction safety signage and its meanings
- general construction emergency response and evacuation procedures
- general construction work activities that require licenses, tickets or certificates of competency
- general first aid response requirements
- general procedures for raising OHS issues
- general procedures for reporting OHS hazards, accidents, incidents, emergencies, injuries, near misses and dangerous occurrences
- general procedures for responding to hazards, incidents and injuries
- general workers' compensation and injury management requirements
- OHS hierarchy of controls
- OHS responsibilities and rights of duty holders, including:
  - persons in control of construction work/projects
  - employers and self-employed persons
  - supervisors
  - employees
  - designers
  - inspectors
  - manufacturers and suppliers
- own responsibilities to comply with safe work practices relating to:
  - housekeeping
  - identification of hazards
  - preventing bullying or harassment
  - smoking
  - use of amenities
  - use of drugs and alcohol
- role of OHS committees and representatives
- types of common personal protective equipment and fire safety equipment
- types of OHS information and documentation.

## Evidence Guide

### EVIDENCE GUIDE

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## EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

#### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence must confirm personal awareness of the following:

- applicable OHS legislative and safety requirements for construction work including duty of care
- the range of common construction hazards and procedures for the assessment of risk and application of the hierarchy of control
- OHS communication processes, information and documentation including the role of OHS committees and representatives, the meaning of common safety signs and symbols, and procedures for reporting hazards, incidents and injuries
- general procedures for responding to incidents and emergencies including evacuation, first aid, fire safety equipment and PPE.

#### **Context of and specific resources for assessment**

- Resources must be available to support the program including participant materials and other information or equipment related to the skills and knowledge covered by the program.
- It is recommended that the assessment tool designed specifically to support this unit of competency will provide consistency in assessment outcomes.
- Where applicable, physical resources should include equipment modified for people with disabilities
- Access must be provided to appropriate assessment support when required.
- Assessment processes and techniques must be culturally appropriate, and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed
- In all cases where practical assessment is used it will be combined with targeted questioning to assess the underpinning knowledge. Questioning will be undertaken in such a

## EVIDENCE GUIDE

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manner as is appropriate to the oracy, language and literacy levels of the operator, any cultural issues that may affect responses to the questions, and reflecting the requirements of the competency and the work being performed.

### Method of assessment

Assessment methods may include more than one of the following:

- practical assessment
- oral questioning
- written test
- work-based activities
- simulated project based activity

## Range Statement

### RANGE STATEMENT

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The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

***OHS legislative requirements*** relate to:

- Australian standards
- construction industry OHS standards and guidelines
- duty of care
- health and safety representatives, committees and supervisors
- licences, tickets or certificates of competency
- National Code of Practice for Induction Training for Construction Work
- national safety standards
- OHS and welfare Acts and regulations
- safety codes of practice.

***Duty of care requirements*** relate to:

- legal responsibility under duty of care to do everything reasonably practicable to protect others from harm

## RANGE STATEMENT

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	<ul style="list-style-type: none"> <li>• own responsibilities to comply with safe work practices, including activities that require licences, tickets or certificates of competency</li> <li>• relevant state OHS requirements, including employers and self-employed persons, persons in control of the work site, construction supervisors, designers, manufacturers and suppliers, construction workers, subcontractors and inspectors.</li> </ul>
<b><i>Safe work practices</i></b> include:	<ul style="list-style-type: none"> <li>• access to site amenities, such as drinking water and toilets</li> <li>• general requirements for safe use of plant and equipment</li> <li>• general requirements for use of personal protective equipment and clothing</li> <li>• housekeeping to ensure a clean, tidy and safer work area</li> <li>• no drugs and alcohol at work</li> <li>• preventing bullying and harassment</li> <li>• smoking in designated areas</li> <li>• storage and removal of debris.</li> </ul>
<b><i>Risk</i></b> relates to:	<ul style="list-style-type: none"> <li>• likelihood of a hazard causing injury or harm.</li> </ul>
<b><i>Principles of risk management</i></b> include:	<ul style="list-style-type: none"> <li>• assessing the risks involved</li> <li>• consulting and reporting ensuring the involvement of relevant workers</li> <li>• controlling the hazard</li> <li>• identifying hazards</li> <li>• reviewing to identify change or improvement.</li> </ul>
<b><i>Hazard</i></b> relates to:	<ul style="list-style-type: none"> <li>• any thing (including an intrinsic property of a thing) or situation with the potential to cause injury or harm.</li> </ul>
<b><i>Common construction hazards</i></b> include:	<ul style="list-style-type: none"> <li>• confined spaces</li> <li>• electrical safety</li> <li>• excavations, including trenches</li> <li>• falling objects</li> <li>• hazardous substances and dangerous goods</li> <li>• HIV and other infectious diseases</li> <li>• hot and cold working environments</li> <li>• manual handling</li> <li>• noise</li> <li>• plant and equipment</li> </ul>

## RANGE STATEMENT

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***Measures for controlling*** risk to eliminate or minimise hazards in accordance with the hierarchy of control include:

- traffic and mobile plant
- unplanned collapse
- ultraviolet (UV) radiation
- working at heights.

***OHS communication processes*** include:

- elimination
- substitution
- isolation
- engineering control
- administrative control
- personal protective equipment.
- discussions with OHS representatives
- OHS meetings
- OHS notices, newsletters, bulletins and correspondence
- OHS participative arrangements
- processes for raising OHS issues
- toolbox talks
- workplace consultation relating to OHS issues and changes.

***OHS information and documentation*** includes:

- accident and incident reports
- Acts and regulations
- Australian standards
- codes of practice
- construction documentation and plans
- emergency information contact
- evacuation plans
- guidance notes
- job safety analyses
- labels
- material safety data sheets (MSDS)
- proformas for reporting hazards, incidents and injuries
- reports of near misses and dangerous occurrences
- risk assessments
- safe work method statements
- safety meeting minutes
- site safety inspection reports.

***Designated OHS personnel*** includes:

- first aid officers
- OHS committee members

## RANGE STATEMENT

***Safety signs and symbols*** include:

- OHS representatives
- supervisors.
- emergency information signs (e.g. exits, equipment and first aid)
- fire signs (e.g. location of fire alarms and firefighting equipment)
- hazard signs (e.g. danger and warning)
- regulatory signs (e.g. prohibition, mandatory and limitation or restriction)
- safety tags and lockout (e.g. danger tags, out of service tags).

***Relevant authorities*** include:

- emergency services (e.g. police, ambulance, fire brigade and emergency rescue)
- OHS regulatory authority
- supervisor.

***Incidents*** include:

- accidents resulting in personal injury or damage to property
- near misses or dangerous occurrences which do not cause injury but may pose an immediate and significant risk to persons or property, and need to be reported so that action can be taken to prevent recurrence, for example:
- breathing apparatus malfunctioning to the extent that the user's health is in danger
- collapse of the floor, wall or ceiling of a building being used as a workplace
- collapse or failure of an excavation more than 1.5 metres deep (including any shoring)
- collapse or partial collapse of a building or structure
- collapse, overturning or failure of the load bearing of any scaffolding, lift, crane, hoist or mine-winding equipment
- damage to or malfunction of any other major plant
- electric shock.
- electrical short circuit, malfunction or explosion
- uncontrolled explosion, fire or escape of gas, hazardous substance or steam
- any other unintended or uncontrolled incident or event arising from operations carried on at a

## RANGE STATEMENT

	workplace.
<i>General procedures</i> for responding to incidents and emergencies include:	<ul style="list-style-type: none"> <li>• basic emergency response (keep calm, raise alarm, obtain help)</li> <li>• evacuation</li> <li>• notification of designated OHS personnel and authorities</li> <li>• notification of emergency services (e.g. when and how)</li> <li>• referring to site emergency plans and documentation.</li> </ul>
<i>Emergencies</i> include:	<ul style="list-style-type: none"> <li>• chemical spill</li> <li>• fire</li> <li>• injury to personnel</li> <li>• structural collapse</li> <li>• toxic and/or flammable vapours emission</li> <li>• vehicle/mobile plant accident.</li> </ul>
<i>Personal protective equipment</i> includes:	<ul style="list-style-type: none"> <li>• aprons</li> <li>• arm guards</li> <li>• eye protection</li> <li>• gloves</li> <li>• hard hat</li> <li>• hearing protection</li> <li>• high visibility retro reflective vests</li> <li>• protective, well fitting clothing</li> <li>• respiratory protection</li> <li>• safety footwear</li> <li>• UV protective clothing and sunscreen.</li> </ul>
<i>Fire safety equipment</i> includes:	<ul style="list-style-type: none"> <li>• breathing apparatus</li> <li>• fire blankets</li> <li>• firefighting equipment.</li> </ul>

## Unit Sector(s)

Unit sector                      Construction



## **Co-requisite units**

**Co-requisite units** Nil

## **Functional area**

**Functional area**

## CPCPCM4002A Estimate and cost work

### Modification History

Not Applicable

### Unit Descriptor

**Unit descriptor** This unit of competency specifies the outcomes required to estimate materials, labour and time requirements and to establish costs for provision of services or products.

The unit covers the gaining of information, the estimation of materials, labour and time, the calculation of costs and the associated documentation.

### Application of the Unit

**Application of the unit** This unit of competency supports the development of estimating and costing skills relevant to minor plumbing jobs.

### Licensing/Regulatory Information

Not Applicable

### Pre-Requisites

**Prerequisite units** Nil

## Employability Skills Information

**Employability skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Gather information.	<p>1.1.Details of customer requirements are obtained through discussion with customer or from information supplied.</p> <p>1.2.Plans and specifications are accessed and site is inspected.</p> <p>1.3.Details of products and services to be provided are developed.</p> <p>1.4.Delivery point and methods of transportation are determined where necessary.</p> <p>1.5.Details are recorded in accordance with workplace procedures.</p>
2. Estimate materials, labour and time.	<p>2.1.Work, including preparatory tasks, is planned and sequenced.</p> <p>2.2.Types and quantities of materials required for product work are <i>estimated</i>.</p> <p>2.3.Labour requirements to perform work are estimated.</p> <p>2.4.Time requirements to perform work are estimated.</p>
3. Calculate costs.	<p>3.1.Total materials, labour and overhead costs are calculated in accordance with workplace procedures using appropriate <i>equipment</i>.</p> <p>3.2.Total work cost is calculated, including overheads and mark-up percentages.</p>

ELEMENT	PERFORMANCE CRITERIA
	3.3.Final cost for work is calculated.
4. Document and verify details.	4.1.Details of costs and charges are documented in accordance with workplace procedures. 4.2.Costs, calculations and other details are verified in accordance with workplace procedures. 4.3.Customer quotation and tender are prepared. 4.4.Details are documented for future reference in accordance with workplace procedures and using relevant <i>information</i> .

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills for this unit are:

- communication skills to:
  - complete workplace documentation
  - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
  - identify customer requirements
  - prepare quotes and tenders
  - record details, including costs and charges
  - use language and concepts appropriate to cultural differences
  - use and interpret non-verbal communication, such as hand signals
- estimating materials and labour required for a work activity
- determining costs for the provision of a quotation or tender in the plumbing and services industry
- numeracy skills to apply calculations.

#### Required knowledge

Required knowledge for this unit is:

- accessing information and the processes for calculating material requirements
- estimating and calculating processes
- impact of time on wages and other costs

## REQUIRED SKILLS AND KNOWLEDGE

- job safety analysis (JSA) and safe work method statements (SWMS)
- process for estimating and costing work
- relevant statutory and authority requirements related to estimating and costing work
- SI system of measurements
- standards applicable to the work to be undertaken
- tendering and contracting processes
- workplace and equipment safety requirements.

## Evidence Guide

### EVIDENCE GUIDE

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

This unit of competency could be assessed in the workplace or a close simulation of the workplace environment providing that simulated or project-based assessment techniques fully replicate plumbing and services workplace conditions, materials, activities, responsibilities and procedures.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of:

- locating, interpreting and applying relevant information, standards and specifications to the estimation and costing of work
- applying safety requirements throughout the work sequence, including the use of personal protective clothing and equipment
- as a minimum, the ability to estimate and cost three varied jobs in at least Class 1 buildings, including:
  - estimating quantities of material required
  - determining types and amount of labour required to complete the work
  - estimating time required to complete the

## EVIDENCE GUIDE

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	<p>work</p> <ul style="list-style-type: none"> <li>• estimating overheads associated with the job</li> <li>• providing a written quotation and tender for each of the work requirements</li> <li>• communicating and working effectively and safely with others.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This competency is to be assessed using standard and authorised work practices, safety requirements and environmental constraints.</p> <p>Assessment of essential underpinning knowledge will usually be conducted in an off-site context.</p> <p>Assessment is to comply with relevant regulatory or Australian standards' requirements.</p> <p>Resource implications for assessment include:</p> <ul style="list-style-type: none"> <li>• an induction procedure and requirement</li> <li>• realistic tasks or simulated tasks covering the minimum task requirements</li> <li>• relevant specifications and work instructions</li> <li>• tools and equipment appropriate to applying safe work practices</li> <li>• support materials appropriate to activity</li> <li>• workplace instructions relating to safe working practices and addressing hazards and emergencies</li> <li>• material safety data sheets</li> <li>• research resources, including industry related systems information.</li> </ul> <p>Reasonable adjustments for people with disabilities must be made to assessment processes where required. This could include access to modified equipment and other physical resources, and the provision of appropriate assessment support.</p>
<b>Method of assessment</b>	<p>Assessment methods must:</p> <ul style="list-style-type: none"> <li>• satisfy the endorsed Assessment Guidelines of the Construction, Plumbing and Services Training Package</li> <li>• include direct observation of tasks in real or simulated work conditions, with questioning to</li> </ul>

## EVIDENCE GUIDE

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confirm the ability to consistently identify and correctly interpret the essential underpinning knowledge required for practical application

- reinforce the integration of employability skills with workplace tasks and job roles
- confirm that competency is verified and able to be transferred to other circumstances and environments.

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice, with a decision on competency only taken at the point when the assessor has complete confidence in the person's demonstrated ability and applied knowledge
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence.

Assessment processes and techniques should as far as is practical take into account the language, literacy and numeracy capacity of the candidate in relation to the competency being assessed.

Supplementary evidence of competency may be obtained from relevant authenticated documentation from third parties, such as existing supervisors, team leaders or specialist training staff.

## Range Statement

### RANGE STATEMENT

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## RANGE STATEMENT

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The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Factors for *estimation* and costing include:

- labour
- materials
- overheads.

*Equipment* may include:

- calculators
- computers running appropriate software to estimate and calculate necessary details
- measuring equipment appropriate to work
- stationery.

*Information* may include:

- charts and hand drawings
- diagrams or sketches
- instructions issued by authorised organisational or external personnel
- job drawings
- manufacturer specifications and instructions
- material safety data sheets (MSDS)
- memos
- organisation work specifications and requirements
- regulatory and legislative requirements, particularly those pertaining to:
  - building codes
  - OHS and environmental requirements
  - plumbing regulations
- relevant Australian standards
- safe work procedures relating to estimating and costing work
- signage
- verbal, written and graphical instructions
- work bulletins
- work schedules, plans and specifications.



**Unit Sector(s)**

**Unit sector** Plumbing and services

**Co-requisite units**

**Co-requisite units** Nil

**Functional area**

**Functional area**

# **CPPBDN5013A Develop and collaborate on building information models for small-scale building design projects**

## **Modification History**

New unit

## **Unit Descriptor**

This unit of competency specifies the outcomes required to develop three-dimensional (3-D) models of small-scale building design projects covered by the Building Code of Australia (BCA), except construction Type A buildings, into true building information models (BIM).

It also covers adding and adjusting values of components of building designs, collaborating with consultants and contractors from other disciplines, working live within the model alongside other disciplines and creating project documentation using modelling software programs.

## **Application of the Unit**

This unit of competency supports building designers who create and use BIMs to optimise productivity and enhance streamlining of the construction process through improved communication and collaboration with consultants and contractors involved in the construction life cycle.

## **Licensing/Regulatory Information**

Work in this area must be completed according to relevant legislative, industry and organisational requirements, including occupational health and safety (OHS) policies and procedures.

Different states and territories may have regulatory mechanisms that apply to this unit. Users are advised to check for regulatory limitations.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Develop BIM project documentation	1.1	BIM project processes and schedules are planned and finalised in consultation with relevant project stakeholders.
		1.2	Procedures to provide accurate and reliable exchange of project models are developed according to <b><i>organisational and project requirements</i></b> .
		1.3	Project documentation is generated according to organisational and project requirements using outputs of appropriate functions of design technology tools.
2	Develop a BIM project	2.1	Information <b><i>relating to small-scale building design projects</i></b> is analysed and applied to plans for BIM development.
		2.2	3-D models are created according to organisational and project requirements and software operation instructions using appropriate <b><i>design technology tools</i></b> .
		2.3	<b><i>Building design data</i></b> is embedded in project model <b><i>objects</i></b> to allow collaboration, integration and generation of required project documentation.
		2.4	BIM is checked and tested according to organisational and project requirements to confirm accuracy and functionality.
3	Exchange and collaborate on project models	3.1	Transfer of BIM files is tested according to organisational procedures to ensure integrity of format and data is retained on receipt.

- 3.2 BIMs are provided to other consultants or contractors for addition of specialist data according to project requirements and data sharing protocols.
- 3.3 BIMs or BIM data provided by other consultants or contractors are imported or linked and checked for integrity according to project and organisational requirements.
- 3.4 BIMs are amended and manipulated live in collaboration with other contractors and consultants operating within the same model.

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

- administration and management skills to:
  - develop process map, task list and schedule for BIM implementation
  - implement and manage standards
  - manage projects and documents
  - manage time, including planning and prioritising work
- analytical and problem-solving skills to:
  - develop innovative ideas and designs
  - select cost-effective products and materials that contribute to sustainable development
  - work out optimum compliant and cost-effective design solutions
- interpersonal skills to interact with clients and other stakeholders, including planning and regulatory personnel and technical experts
- language, literacy and numeracy skills to:
  - communicate with clients and contacts
  - estimate costs
  - interpret and apply complex information, including legislation, regulations, and codes and standards
  - present design options to clients
- technical skills to:
  - produce accurate design documentation and hand drawings
  - apply compliance requirements, including drawing standards
  - design from a brief
  - plan and carry out design, including visualising spaces, form, shapes and light

- technology skills to use information technology, BIM technologies and relevant software

### Required knowledge

- architectural styles and terminology
- basic principles of structural engineering
- building designers' duty of care to ensure quality and safety of designs
- benefits and challenges of adopting a BIM approach to design production and documentation
- contextual and site constraints
- conventional and sustainable construction materials and methods, including their application, behaviour, characteristics, performance and interactions with other materials
- design development and approval processes, and implications of changes to design at each stage
- design drawing and representation methods
- design technology's built-in tools and networking tools required to maintain two or more disciplines in a single project model within a local area network (LAN)
- tools required to manage a project with two or more disciplines across a wide area network (WAN)
- hazards of site, materials, construction practices and building use over life cycle
- key features of building life cycles
- legislation, codes and standards relevant to sustainable design requirements for small-scale building design projects
- organisational scope of business, service levels and fees
- planning processes and requirements
- pricing of resources
- principles of integrated project delivery
- principles of sustainable design
- project management strategies
- scientific and social principles of human interactions with the built environment
- tools required to create a realistic BIM implementation plan that responds to specific staff, financial and schedule constraints

### Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence	A person should demonstrate the ability to: <ul style="list-style-type: none"><li>• produce interactive BIM projects for a range of small-scale</li></ul>
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required to demonstrate competency in this unit	<p>building design projects in consultation with project team</p> <ul style="list-style-type: none"> <li>collaborate on BIM projects with a range of stakeholders, including: <ul style="list-style-type: none"> <li>integration of imported data</li> <li>live interoperations.</li> </ul> </li> </ul>
Context of and specific resources for assessment	<p>Assessment of this unit:</p> <ul style="list-style-type: none"> <li>must be in the context of the work environment</li> <li>may be conducted in an off-site context, provided it is realistic and sufficiently rigorous to cover all aspects of workplace performance, including task skills, task management skills, contingency management skills and job role environment skills</li> <li>must meet relevant compliance requirements.</li> </ul> <p>Resource implications for assessment include:</p> <ul style="list-style-type: none"> <li>access to: <ul style="list-style-type: none"> <li>suitable assessment venue and equipment</li> <li>suitable simulated or real opportunities and resources to demonstrate competence</li> </ul> </li> <li>assessment instruments.</li> </ul>
Method of assessment	<p>Assessment for this unit must verify the practical application of the required skills and knowledge, using one or more of the following methods:</p> <ul style="list-style-type: none"> <li>written and/or oral assessment of the candidates required knowledge for the unit</li> <li>observed, documented and/or firsthand testimonial evidence of the candidates</li> <li>implementation of appropriate procedures and techniques for the safe, effective and efficient achievement of the required outcomes</li> <li>identification of the relevant information and scope of the work required to meet the required outcomes</li> <li>identification of viable options and the selection of options that best meet the required outcomes</li> <li>consistently achieving the required outcomes.</li> </ul>
Guidance information for assessment	<p>This unit could be assessed on its own or in combination with other units relevant to the job function.</p> <p>Where applicable, physical resources should include equipment modified for people with disabilities.</p> <p>Access must be provided to appropriate learning and/or assessment support when required.</p> <p>Assessment processes and techniques must be culturally</p>

	appropriate, and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b><i>Organisational and project requirements</i></b> may include:	<ul style="list-style-type: none"> <li>communications protocols</li> <li>file exchange formats</li> <li>reporting requirements</li> <li>schedule.</li> </ul>
<b><i>Small-scale building design projects:</i></b>	<ul style="list-style-type: none"> <li>include buildings covered by the BCA, except construction Type A buildings</li> <li>may be residential projects, such as: <ul style="list-style-type: none"> <li>additions and renovations</li> <li>heritage restoration</li> <li>new buildings</li> </ul> </li> <li>may be commercial or industrial projects, such as: <ul style="list-style-type: none"> <li>factories</li> <li>motels</li> <li>offices</li> <li>restaurants</li> <li>retail and service outlets</li> <li>warehouses.</li> </ul> </li> </ul>
<b><i>Design technology tools</i></b> may include:	<ul style="list-style-type: none"> <li>proprietary 3, 4 and 5-D modelling software, such as: <ul style="list-style-type: none"> <li>Autodesk Architectural Desktop</li> <li>Autodesk Revit</li> <li>Bentley Architecture</li> <li>Graphisoft ArchiCAD</li> <li>VectorWorks ARCHITECT.</li> </ul> </li> </ul>
<b><i>Building design data</i></b> may include:	<ul style="list-style-type: none"> <li>details of compliance requirements, including those specified in: <ul style="list-style-type: none"> <li>Australian standards</li> <li>client requirements</li> <li>design specifications</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• legislation and regulations</li><li>• manufacturer specifications</li><li>• dimensions</li><li>• labour costs</li><li>• material costs</li><li>• material properties, such as:<ul style="list-style-type: none"><li>• acoustic values</li><li>• energy efficiency</li><li>• fire resistance</li><li>• R-value and U-value</li><li>• strength.</li></ul></li></ul>
<i>Objects</i> may include:	<ul style="list-style-type: none"><li>• customised imports</li><li>• imports from online object libraries</li><li>• new objects created by the designer.</li></ul>

## Unit Sector(s)

Building design

## Custom Content Section

Not applicable.



## CUFIND201A Develop and apply creative arts industry knowledge

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to develop and apply basic industry practices within the creative arts industries.</p> <p>This unit addresses the collection, application and updating of general information relevant to work roles within the creative arts industry sectors, including industry structures and operations, employment obligations and opportunities, the impact of new technology and the identification of industry laws and regulations.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit underpins effective performance within the following industry sectors:</p> <ul style="list-style-type: none"><li>• Entertainment</li><li>• Film, Television, Radio and Interactive Media</li><li>• Museums and Library Services</li><li>• Music</li><li>• Visual Arts, Craft and Design.</li></ul> <p>This unit requires a basic application of creative arts industry knowledge. The advanced application of creative arts industry knowledge is addressed in individual units developed for specific job tasks.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
Source and apply industry information	<ol style="list-style-type: none"> <li>1. Seek information on the <b><i>structure and operation</i></b> of the <b><i>creative arts industries</i></b> using <b><i>appropriate sources</i></b></li> <li>2. Seek information on <b><i>employment obligations and opportunities</i></b> within the creative arts industries using appropriate sources</li> <li>3. Seek information on <b><i>new technology</i></b> affecting the creative arts industries using appropriate sources</li> </ol>

ELEMENT	PERFORMANCE CRITERIA
	4. Comply with copyright requirements when accessing information 5. Apply information in day-to-day work activities to enhance quality of work performance
Identify industry laws and regulations	6. Seek information on <b><i>laws and regulations</i></b> affecting the creative arts industries using appropriate sources 7. Identify implications of breaching laws and regulations affecting the creative arts industries 8. Apply information to ensure laws and regulations are not breached in day-to-day work activities
Update and maintain industry knowledge	9. Identify and use a range of opportunities to update knowledge of the creative arts industries 10. Identify <b><i>current issues of concern</i></b> to the creative arts industries 11. Share updated knowledge with colleagues 12. Establish and maintain effective contacts in the creative arts industries

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication skills sufficient to communicate industry information to colleagues
- learning skills sufficient to maintain knowledge of industry information
- literacy skills sufficient to read and understand industry information and terminology
- numeracy skills sufficient to interpret relevant technical data
- planning and organising skills sufficient to identify relevant industry information
- technology skills sufficient to access and download industry information

#### Required knowledge

- basic understanding of the following areas and how they apply to day-to-day work activities (in relation to the particular creative arts industry sector in which knowledge is being assessed):
  - industry structure and operation
  - employment obligations and opportunities

**REQUIRED SKILLS AND KNOWLEDGE**

- new technology
- laws and regulations
- current issues of concern

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- ability to source industry information
- ability to seek appropriate assistance to collect industry information
- ability to apply industry information to day-to-day work activities to enhance work outcomes
- understanding of the ways in which to maintain currency of industry knowledge.

**Context of and specific resources for assessment**

This unit of competency applies to a range of creative arts industry sectors. The focus of assessment will therefore depend on the industry sector involved. Assessment must be customised to meet the needs of the particular industry sector in which performance is being assessed. Assessment should only address those variable circumstances, listed in the range statement, which apply to the chosen context.

Assessment must ensure:

- access to appropriate technology to collect, download and store industry information
- access to a range of relevant and current industry information
- access to appropriate learning and assessment support when required
- use of culturally appropriate processes and techniques appropriate to the language and literacy

EVIDENCE GUIDE	
	capacity of learners and the work being performed.
<b>Method of assessment</b>	<p>The following assessment methods are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of the candidate collecting and organising industry information</li> <li>• case studies to assess ability to apply knowledge to different industry contexts and situations</li> <li>• written or oral questioning to test knowledge of the different aspects or distinguishing features of the creative arts industries</li> <li>• review of portfolios of evidence and third-party workplace reports of on-the-job performance, including authenticated samples of work in collecting and organising industry information.</li> </ul>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b><i>Structure and operation</i></b> may include:	<ul style="list-style-type: none"> <li>• distribution channels for products and services</li> <li>• industry sectors and their products and services</li> <li>• key contacts and support networks</li> <li>• major industry bodies and associations</li> <li>• prominent practitioners and practices</li> <li>• relationship with other creative arts industry sectors</li> <li>• specific features of local and regional industry sectors, including their relationship with local community.</li> </ul>
<b><i>Creative arts industries</i></b> may	<ul style="list-style-type: none"> <li>• Entertainment</li> </ul>

<b>RANGE STATEMENT</b>	
include:	<ul style="list-style-type: none"> <li>• Film, Television, Radio and Interactive Media</li> <li>• Museums and Library Services</li> <li>• Music</li> <li>• Visual Arts, Craft and Design.</li> </ul>
<i>Appropriate sources</i> may include:	<ul style="list-style-type: none"> <li>• agents and artists' managers</li> <li>• copyright representatives</li> <li>• discussions with current industry practitioners, colleagues and community groups</li> <li>• electronic and print media, including news, reviews and articles</li> <li>• employee and industry association representatives</li> <li>• events, including industry functions, conferences, trade fairs, community activities, expositions, exhibitions, festivals and social events</li> <li>• government bodies and associated publications</li> <li>• induction kits</li> <li>• industry managers</li> <li>• internet</li> <li>• libraries and telephone books</li> <li>• peak copyright organisations</li> <li>• personal observations and experience</li> <li>• reference books, industry information sheets, magazines and journals</li> <li>• retail and wholesale suppliers of products and services</li> <li>• technical publications</li> <li>• training programs, seminars, conferences, symposiums, workshops, master classes and other professional development opportunities</li> <li>• union publications (e.g. newsletters, magazines, bulletins and letters) and other sources of industrial relations information.</li> </ul>
<i>Employment obligations and opportunities</i> may include:	<ul style="list-style-type: none"> <li>• career opportunities and career paths</li> <li>• codes of conduct and codes of ethics</li> <li>• employer bodies and professional associations</li> <li>• employment conditions</li> <li>• employment contracts and job descriptions</li> <li>• industrial relations issues, including award provisions, enterprise bargaining agreements and non-award areas</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• roles, responsibilities and employment rights of individuals and contracted freelance workers</li> <li>• unions.</li> </ul>
<i>New technology</i> may include:	<ul style="list-style-type: none"> <li>• advances in any type of equipment or technology used within the industry</li> <li>• likely effects of new technology on current work practices and the structure of the industry</li> <li>• sources of technical advice and support</li> <li>• ways of upgrading skills to allow for the use of new technology.</li> </ul>
<i>Laws and regulations</i> may include:	<ul style="list-style-type: none"> <li>• anti-discrimination</li> <li>• consumer protection</li> <li>• contempt of court</li> <li>• copyright</li> <li>• defamation</li> <li>• duty of care</li> <li>• environmental issues</li> <li>• equal employment opportunity</li> <li>• industrial relations, awards and enterprise agreements</li> <li>• insurance issues</li> <li>• intellectual property</li> <li>• libel</li> <li>• obscenity</li> <li>• OHS</li> <li>• plagiarism</li> <li>• privacy legislation</li> <li>• racial vilification</li> <li>• slander.</li> </ul>
<i>Current issues of concern</i> may include:	<ul style="list-style-type: none"> <li>• changing nature of the marketplace, including marketing and production of products and services</li> <li>• cultural protocols</li> <li>• funding policies</li> <li>• government initiatives</li> <li>• importing and exporting issues</li> <li>• industry contraction or expansion</li> <li>• insurance issues</li> <li>• taxation issues</li> <li>• trends in industry practice.</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Competency field**

<b>Competency field</b>	Industry capability - industry context
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**Co-requisite units**

<b>Co-requisite units</b>		



## CUFRES401A Conduct research

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This unit describes the performance outcomes, skills and knowledge required to conduct research in response to a brief.</p> <p>No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>People responsible for undertaking research in any industry context apply the skills and knowledge described in this unit. They may be full-time research officers or those for whom research forms part of their job. Alternatively, they may provide research services on a contract basis.</p> <p>Research briefs can cover any topic and research may be undertaken over short or long periods, depending on the complexity of the brief. Even though people at this level work with a fair degree of autonomy, they report to a manager or client.</p> <p>Skills associated with writing reports are covered in:</p> <ul style="list-style-type: none"><li>• BSBWRT401A Write complex documents.</li></ul>
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
Clarify research brief	<ol style="list-style-type: none"> <li>1. Confirm topic or content to be researched with <b><i>relevant personnel</i></b>, including deadlines for completion</li> <li>2. Identify <b><i>research and data gathering techniques</i></b> that best meet the requirements of the brief</li> <li>3. Discuss research ideas fully and constructively with relevant personnel and identify any implications for research briefs</li> <li>4. Reach agreement with relevant personnel on the <b><i>format for presenting research findings</i></b></li> <li>5. Identify issues of a culturally sensitive or <b><i>legal nature</i></b> that affect research briefs</li> <li>6. Alert relevant personnel to potential difficulties in meeting briefs and agree on alternative strategies or</li> </ol>

ELEMENT	PERFORMANCE CRITERIA
	<p>outcomes</p> <p>7. Where specialist research expertise is required, identify potential subcontractors and organise subcontract arrangements in consultation with relevant personnel</p>
Conduct research	<p>8. Identify <i>sources of information</i> and potential contributors relevant to research briefs</p> <p>9. Design <i>research tools</i> as required</p> <p>10. Contact a sufficiently wide range of valid sources to optimise information gathering in line with research briefs and agreed methodology</p> <p>11. Approach relevant sources promptly and in a way most likely to elicit the required information</p> <p>12. Adjust research strategies as required, without compromising required outcomes</p> <p>13. Maintain accurate and comprehensive details of information sources</p> <p>14. Adjust contact information when requirements of research briefs change and keep records up to date</p> <p>15. Record all data gathered in a <i>system</i> that allows easy access and retrieval of information in the analysis phase</p>
Analyse research findings	<p>16. Analyse and interpret data or information gathered</p> <p>17. Check all facts before including them in research findings</p> <p>18. Make judgements about how much information to include in research findings and be clear on the rationale for doing so</p> <p>19. Develop conclusions and recommendations as required in consultation with relevant personnel</p>
Present research findings	<p>20. Organise information logically and clearly in the agreed format</p> <p>21. Present information to relevant personnel by agreed deadlines</p> <p>22. Identify key issues for further research or discussion with relevant personnel</p> <p>23. Seek feedback on the quality of research outcomes and note areas for improvement</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communication and teamwork skills sufficient to:
  - present information and research findings in a way that is easily understood by others
  - use industry and community networks as sources of information
  - negotiate changes to research briefs
  - participate in and act on feedback sessions with colleagues
- initiative and flexibility sufficient to:
  - follow new leads in the course of research activities
  - respond to difficulties encountered during the course of research activities
- planning and writing skills sufficient to:
  - organise information logically in line with its intended purpose
  - document research findings clearly and concisely
- analytical and literacy skills sufficient to interpret and summarise information and research findings
- self-management skills sufficient to work under pressure and meet deadlines

#### Required knowledge

- effective communication techniques, including effective listening, questioning and non-verbal cues
- legal issues that affect research activities, e.g. copyright, intellectual property and privacy legislation
- reliable sources of advice on legal issues
- features of commonly used quantitative and qualitative research methodologies
- protocols to be observed when collecting information of a culturally sensitive nature
- OHS standards as they relate to working for periods of time on computers

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>EVIDENCE GUIDE</b>	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the following is essential:</p> <ul style="list-style-type: none"> <li>• ability to clarify research briefs</li> <li>• ability to gather reliable and valid information from a range of sources in response to research briefs</li> <li>• research findings on a range of topics presented in an appropriate format by agreed deadlines</li> <li>• collaborative approach to work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to a computer and the internet</li> <li>• access to a range of information sources as listed in the range statement</li> <li>• access to appropriate learning and assessment support when required</li> <li>• use of culturally appropriate processes and techniques appropriate to the language and literacy capacity of learners and the work being performed.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct questioning combined with review of portfolios of evidence and third-party workplace reports of on-the-job performance</li> <li>• evaluation of research findings prepared by the candidate in response to a range of briefs</li> <li>• written or oral questioning to test knowledge as listed in the required skills and knowledge section of this unit and to discuss candidate's approach to conducting research.</li> </ul>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBWRT401A Write complex documents</li> <li>• CUFPMP401A Produce programs and program segments.</li> </ul>

## Range Statement

RANGE STATEMENT	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b><i>Relevant personnel</i></b> may include:	<ul style="list-style-type: none"> <li>• clients</li> <li>• designers</li> <li>• directors</li> <li>• industry organisations</li> <li>• managers</li> <li>• producers</li> <li>• specialist subcontractors</li> <li>• supervisors.</li> </ul>
<b><i>Research and data gathering techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• qualitative, e.g. focus groups or interviews with key people</li> <li>• quantitative, e.g. mail or telephone surveys based on a statistically reliable random sample.</li> </ul>
<b><i>Formats for presenting research findings</i></b> may include:	<ul style="list-style-type: none"> <li>• audio and visual presentations</li> <li>• interactive media presentations</li> <li>• verbal briefings or presentations</li> <li>• written reports.</li> </ul>
Issues of a <b><i>legal nature</i></b> may include:	<ul style="list-style-type: none"> <li>• contempt of court</li> <li>• copyright</li> <li>• defamation</li> <li>• intellectual property</li> <li>• obscenity</li> <li>• privacy legislation</li> <li>• racial vilification.</li> </ul>
<b><i>Sources of information</i></b> may include:	<ul style="list-style-type: none"> <li>• archives</li> <li>• community organisations</li> <li>• government departments</li> <li>• industry and trade journals</li> <li>• internet</li> <li>• libraries, including text, film, video, sound and graphic</li> <li>• market research companies</li> <li>• media, including television, radio and print</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"> <li>• museums and galleries</li> <li>• organisational policies, procedures and journals</li> <li>• personal observations and experience</li> <li>• print and online standard references, such as:               <ul style="list-style-type: none"> <li>• atlases</li> <li>• dictionaries of biography</li> <li>• encyclopaedias</li> <li>• year books and almanacs</li> <li>• directories of people and associations</li> <li>• telephone directories</li> </ul> </li> <li>• professional and industry organisations</li> <li>• technical publications and manuals.</li> </ul>
<i>Research tools</i> may include:	<ul style="list-style-type: none"> <li>• questions for personal interviews or focus groups</li> <li>• surveys, e.g. print, online or telephone.</li> </ul>
<i>Systems</i> may include:	<ul style="list-style-type: none"> <li>• electronic, e.g. databases, spreadsheets and statistical software applications</li> <li>• manual, e.g. card index file.</li> </ul>

## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Knowledge management - research
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## Co-requisite units

Co-requisite units	





## CUVACD304A Make scale models

### Modification History

Version	Comments
CUVACD304A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to make three-dimensional (3-D) physical scale models in response to specifications. It does not cover the use of 3-D digital software which can be found in 'CUFANM303A Create 3D digital models', a unit in CUF07 Screen and Media Training Package.

### Application of the Unit

People working in many industries use scale models as part of the design process. Models are required for production design for live theatre and events, as well as film and television productions. More broadly, individuals working with any 3-D form use and make scale models to inform their work.

At this level, models would be relatively straightforward in nature, and be built based on supplied specifications and requirements. Work would be undertaken with some guidance from others.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Prepare to make scale models	<p>1.1 Clarify scale model requirements based on relevant <b><i>documentation, verbal briefs</i></b> and consultation with <b><i>relevant people</i></b></p> <p>1.2 Identify potential challenges and plan work to minimise risk in consultation with relevant personnel</p> <p>1.3 Select <b><i>techniques</i></b> for model making consistent with project objectives and <b><i>parameters</i></b></p> <p>1.4 Confirm requirements for presenting final <b><i>scale models</i></b></p> <p>1.5 Confirm <b><i>equipment, materials</i></b> and <b><i>work space requirements</i></b></p> <p>1.6 Set up work space and equipment according to <b><i>safety considerations</i></b> and organisational procedures</p>
2. Complete model construction	<p>2.1 Safely make preliminary models representing core dimensions in line with specifications</p> <p>2.2 Review preliminary models against objectives and specifications in consultation with others as required</p> <p>2.3 Make adjustments to models as required</p> <p>2.4 Complete models consistent with objectives and other parameters</p> <p>2.5 Present models to relevant colleagues in line with project and organisational requirements</p> <p>2.6 Follow organisational storage and <b><i>inventory procedures</i></b></p> <p>2.7 Seek and use feedback from others to improve own skills</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to work with others in the model making process
- initiative and enterprise skills to construct scale models that respond to specifications
- learning skills to improve own skills in constructing scale models
- literacy skills to interpret specifications and briefs for scale models
- numeracy skills to interpret and correctly apply calculations and measurements required for the production of scale models
- planning and organising skills to:
  - plan work tasks in a logical sequence
  - organise resources
- problem-solving skills to identify and resolve common problems in model making
- self-management skills to complete work within agreed timeframes.

### Required knowledge

- ways in which model making is used in specific industry contexts
- basic principles of model making, including the physical properties and capabilities of the range of equipment, tools and materials used for model making
- ways in which to present finished scale models
- work space requirements for the production of models, including set-up of work space for particular types of work
- issues and challenges that arise in making scale models
- intellectual property issues and legislation associated with making scale models
- sustainability issues associated with equipment, tools and materials used in scale model making
- OHS procedures for scale model making.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and</b>	Evidence of the ability to: <ul style="list-style-type: none"><li>• apply selected techniques to make models consistent with</li></ul>

<b>evidence required to demonstrate competency in this unit</b>	<p>project objectives and parameters</p> <ul style="list-style-type: none"> <li>• demonstrate knowledge of the processes and techniques used for making scale models</li> <li>• present finished scale models in an appropriate way.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• tools and equipment required to construct scale models.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of the candidate constructing models</li> <li>• evaluation of scale models made by the candidate</li> <li>• oral or written questioning to assess knowledge of scale model making techniques</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling.</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBDES303A Explore and apply the creative design process to 3D forms.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Documentation</b> may include briefs or specifications with information, such as:	<ul style="list-style-type: none"> <li>• background information about clients</li> <li>• budget</li> <li>• clients' needs</li> <li>• considerations, such as:</li> </ul>
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	<ul style="list-style-type: none"> <li>• contractual</li> <li>• copyright</li> <li>• ethical</li> <li>• legal</li> <li>• creative objectives</li> <li>• diagrams indicating, for example: <ul style="list-style-type: none"> <li>• colours</li> <li>• measurements</li> <li>• scale</li> <li>• style</li> </ul> </li> <li>• materials</li> <li>• personnel involved in the project</li> <li>• purpose</li> <li>• relevant statutory requirements, e.g. health and safety considerations</li> <li>• requirements for development or building consent</li> <li>• scope for making adjustments</li> <li>• sponsorship</li> <li>• technical objectives</li> <li>• technology</li> <li>• timeframe</li> <li>• visual representation of scale model.</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• art department</li> <li>• client</li> <li>• creative director</li> <li>• designer</li> <li>• director</li> <li>• head of department</li> <li>• manager</li> <li>• mentor</li> <li>• other technical or specialist personnel</li> <li>• producer</li> <li>• production manager</li> <li>• project manager</li> <li>• representative of organisation commissioning the work</li> <li>• supervisor</li> <li>• technical director.</li> </ul>
<b><i>Techniques</i></b> may relate to:	<ul style="list-style-type: none"> <li>• carpentry</li> <li>• ceramics</li> <li>• glasswork</li> <li>• lighting, such as:</li> </ul>

	<ul style="list-style-type: none"> <li>• ambient</li> <li>• laser</li> <li>• spot</li> <li>• modelling with flexible materials</li> <li>• painting and other surface decoration</li> <li>• projection</li> <li>• manufacture of form by: <ul style="list-style-type: none"> <li>• bending</li> <li>• folding</li> <li>• hinging</li> <li>• sculpture</li> <li>• twisting</li> <li>• working with textiles.</li> </ul> </li> </ul>
<i>Scale models</i> may be required for a wide range of work situations, such as:	<ul style="list-style-type: none"> <li>• event design</li> <li>• foyer design</li> <li>• lighting plots</li> <li>• object or product design</li> <li>• open space environment</li> <li>• room, site and stage layouts</li> <li>• set design, such as for: <ul style="list-style-type: none"> <li>• theatre</li> <li>• screen and media productions</li> </ul> </li> <li>• visual artworks and projects, such as: <ul style="list-style-type: none"> <li>• ceramic pieces</li> <li>• community installations</li> <li>• performance</li> <li>• public art</li> <li>• sculpture.</li> </ul> </li> </ul>
<i>Equipment</i> may include:	<ul style="list-style-type: none"> <li>• brushes</li> <li>• buckets</li> <li>• clamps and pliers</li> <li>• containers</li> <li>• hand and power tools, such as: <ul style="list-style-type: none"> <li>• compressor</li> <li>• drills</li> <li>• saws</li> <li>• sanders</li> </ul> </li> <li>• lighting</li> <li>• protective clothing</li> <li>• scrapers</li> </ul>

	<ul style="list-style-type: none"> <li>• shaping tools, such as:             <ul style="list-style-type: none"> <li>• carving tools</li> <li>• planers</li> <li>• surfboard blades</li> </ul> </li> <li>• spatulas</li> <li>• specialised equipment for ceramic work</li> <li>• specialised equipment for sculpture work</li> <li>• spray gun.</li> </ul>
<b>Materials</b> may include:	<ul style="list-style-type: none"> <li>• bolts</li> <li>• cardboard</li> <li>• charcoal</li> <li>• clays</li> <li>• coloured pencils</li> <li>• crayons</li> <li>• extenders and binders</li> <li>• fibreglass</li> <li>• foamcore</li> <li>• found objects and materials</li> <li>• glass</li> <li>• hooks</li> <li>• inks</li> <li>• laminates</li> <li>• latex</li> <li>• materials to represent a particular surfaces, such as:             <ul style="list-style-type: none"> <li>• earth</li> <li>• rock</li> <li>• water</li> </ul> </li> <li>• metals, such as:             <ul style="list-style-type: none"> <li>• sheet</li> <li>• wire</li> </ul> </li> <li>• nails</li> <li>• natural and synthetic fibres</li> <li>• paper</li> <li>• paper pulp</li> <li>• pastels</li> <li>• perspex</li> <li>• polystyrene</li> <li>• recycled materials</li> <li>• resins</li> <li>• rubber</li> <li>• screws</li> </ul>

	<ul style="list-style-type: none"> <li>• solvents and cleaning materials</li> <li>• specialised metal and wood primers</li> <li>• string</li> <li>• tape</li> <li>• turps</li> <li>• water and oil-based paints</li> <li>• waterproof lacquers</li> <li>• wood and timber products, such as:             <ul style="list-style-type: none"> <li>• balsa wood</li> <li>• MDF board</li> <li>• wooden skewers.</li> </ul> </li> </ul>
<b>Work space</b> requirements may include:	<ul style="list-style-type: none"> <li>• drying space</li> <li>• dust extraction</li> <li>• lighting and power requirements</li> <li>• location-specific requirements</li> <li>• process-specific space needs</li> <li>• ventilation</li> <li>• wet and dry areas.</li> </ul>
<b>Safety considerations</b> may include:	<ul style="list-style-type: none"> <li>• federal, state and territory legislation, regulations and standards</li> <li>• personal protection</li> <li>• recycling</li> <li>• safe disposal of waste.</li> </ul>



<b><i>Inventory procedures</i></b> may involve:	<ul style="list-style-type: none"><li>• files, including digital</li><li>• notes on future use of scale models</li><li>• product safety labels</li><li>• spreadsheet documentation</li><li>• written and visual documentation of manufacturers' instructions.</li></ul>
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## Unit Sector(s)

Visual communication – art, craft and design

## CUVACD504A Research and apply light and colour

### Modification History

Version	Comments
CUVACD504A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to research light and colour, and to develop own ideas about the use of light and colour for integration into a body of creative work.

### Application of the Unit

Visual artists and designers working across art forms and design disciplines have expertise in the use of light and colour. This unit is also relevant to photographers. It may be applied in traditional or digital contexts.

At this level, this expertise would be demonstrated within a body of professional creative work. The practitioner is working independently with access to mentoring and guidance as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Research light and colour	1.1 Source <b><i>information and ideas</i></b> about the use of light and colour in art and design practice 1.2 Research the use of light and colour in historical and contemporary contexts 1.3 Research the use of light and colour in <b><i>multidisciplinary and transdisciplinary contexts</i></b>
2. Develop own ideas about light and colour	2.1 Analyse and distil <b><i>relevant ideas and information</i></b> from research 2.2 Reflect on the <b><i>application of light and colour</i></b> in own practice 2.3 Develop <b><i>informed positions</i></b> about the use of light and colour in own work and the work of others 2.4 Examine the ways in which digital technology impacts on the use of light and colour in own practice 2.5 Refine ideas through ongoing <b><i>discussion and debate</i></b>
3. Integrate light and colour into a body of work	3.1 Achieve different effects through manipulation of light and colour in own work 3.2 Experiment with different aspects of light and colour 3.3 Challenge and adapt uses of light and colour to suit own practice 3.4 Show command of the use of light and colour in a <b><i>body of creative work</i></b>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to discuss technical and conceptual aspects of creative works
- critical thinking and analytical skills to:
  - evaluate and make judgements about relationships between light and colour, effects and ideas (within and outside of a visual arts context)
  - make critical evaluations about light and colour
- initiative and enterprise skills to identify and act on opportunities for own practice presented by the use of light and colour
- learning skills to develop and refine own approach to the use of light and colour
- literacy skills to analyse complex and varied information
- problem-solving skills to identify and resolve technical problems with the use of light and colour
- self-management and planning skills to draw together research and experimentation processes for benefit of own work
- technology skills to conduct web-based research

### Required knowledge

- historical and contemporary use of light and colour in own area of creative practice
- ways that light and colour are used in other creative disciplines and more broadly in areas of business, science and technology
- commonly used research methodologies for artists
- intellectual property issues and legislation associated with arts practice
- sustainability issues associated with the tools and materials used in the particular area of work
- OHS procedures in relation to area of work

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and</b>	Evidence of the ability to:

<b>evidence required to demonstrate competency in this unit</b>	<ul style="list-style-type: none"> <li>• develop an individual approach to the use of light and colour in own work</li> <li>• produce a coherent body of professional artwork that shows a command of light and colour</li> <li>• research the use of light and colour, both within and beyond the visual arts context.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• equipment, materials and tools used in the relevant art form.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of the use of light and colour within a body of work produced by the candidate</li> <li>• evaluation of processes used by the candidate to explore light and colour</li> <li>• direct observation of work in progress, including exploration of, and experimentation with, techniques</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• art form specialisation units</li> <li>• graphic design units</li> <li>• photo imaging units.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<p><b><i>Information and ideas</i></b> may come from:</p>	<ul style="list-style-type: none"> <li>• artworks</li> <li>• commercial briefs</li> <li>• critical writing</li> <li>• events</li> <li>• exhibitions</li> <li>• experiences of self or others</li> <li>• films</li> <li>• images</li> <li>• internet</li> <li>• music</li> <li>• objects</li> <li>• other people</li> <li>• performances</li> <li>• presentations</li> <li>• printed texts</li> <li>• technical information.</li> </ul>
<p><b><i>Multidisciplinary and transdisciplinary contexts</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• across other art forms</li> <li>• business</li> <li>• science</li> <li>• technology.</li> </ul>
<p><b><i>Relevant ideas and information</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• media</li> <li>• new concepts for work</li> <li>• techniques.</li> </ul>
<p><b><i>Application of light and colour</i></b> may relate to:</p>	<ul style="list-style-type: none"> <li>• aspects of colour:             <ul style="list-style-type: none"> <li>• hue</li> <li>• intensity and saturation</li> <li>• value</li> </ul> </li> <li>• brightness</li> <li>• chroma</li> <li>• digital processes</li> <li>• illumination</li> <li>• illusion</li> <li>• reflection</li> <li>• refraction</li> <li>• shadow</li> <li>• use of colour:             <ul style="list-style-type: none"> <li>• additive</li> <li>• complementary colours</li> <li>• contrast</li> <li>• shades</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• subtractive</li><li>• tints</li><li>• tones</li><li>• unity</li><li>• visual adaptation.</li></ul>
<b><i>Informed positions</i></b> may include positions that are:	<ul style="list-style-type: none"><li>• grounded in appropriate research</li><li>• informed by own experimentation</li><li>• result of rational and logical thought</li><li>• subjected to the analysis of others, such as peer review</li><li>• supported by relevant information.</li></ul>
<b><i>Discussion and debate</i></b> may be with:	<ul style="list-style-type: none"><li>• clients</li><li>• employers</li><li>• mentors</li><li>• other creative practitioners</li><li>• peers</li><li>• supervisors.</li></ul>
<b><i>Body of creative work</i></b> may include:	<ul style="list-style-type: none"><li>• any art form, including two-dimensional and three-dimensional</li><li>• design work</li><li>• models</li><li>• props</li><li>• sets</li><li>• sketches.</li></ul>

## Unit Sector(s)

Visual communication – art, craft and design

## CUVACD506A Refine 2-D design ideas and processes

### Modification History

Version	Comments
CUVACD506A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to extend and deepen engagement with two-dimensional (2-D) design ideas and processes for the production of work at a professional level.

### Application of the Unit

Designers and artists engage with a wide and potentially complex range of ideas about 2-D design. At this level they are able to then develop and refine their own ideas and responses to the potential of the 2-D form through the production of professional work.

This unit complements units that focus on specialised skills for particular design disciplines or art forms.

Work may be independent or collaborative. It is largely self-directed with guidance and mentoring available as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Originate ideas for 2-D design	<p>1.1 Generate ideas for design concepts through research, exploration and experimentation</p> <p>1.2 Develop initial design concepts consistent with the intent of the work or <b><i>specifications</i></b> of the brief</p> <p>1.3 Evaluate, explore and play with options that best suit the design brief</p> <p>1.4 Refine options and select the approach that best meets design brief requirements</p>
2. Plan design process	<p>2.1 Develop clear plan and schedule for design realisation</p> <p>2.2 Organise and allocate <b><i>resources</i></b> to meet required standards, timeframes and budget</p> <p>2.3 Liaise with others involved in design realisation as required</p> <p>2.4 Monitor process to ensure integrity of design is maintained, including challenging own design work</p> <p>2.5 Identify difficulties or problems and take action to rectify</p> <p>2.6 Maintain accurate, relevant and complete documentation</p>
3. Refine and consolidate process	<p>3.1 Develop effective 2-D designs and <b><i>design processes</i></b></p> <p>3.2 Develop and document a <b><i>design language</i></b> that reflects own style and approach</p> <p>3.3 Identify opportunities for refinement and re-thinking and make adjustments as required</p> <p>3.4 Articulate the design process and the final solution through effective documentation of work</p>

	3.5 Prepare and present 2-D design solutions to <i>key people</i>
4. Maintain expertise	<p>4.1 Apply <i>professional work ethic</i> to design activities</p> <p>4.2 Use feedback from others to improve own skills in design</p> <p>4.3 Stay up-to-date with industry standards and seek opportunities to further develop technical and conceptual skills</p> <p>4.4 Source new ideas and trends through regular review of the work of others</p> <p>4.5 Keep informed about new creative approaches, techniques, materials and equipment for 2-D design</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to:
  - work collaboratively in the design process
  - create design documentation
- initiative and enterprise skills to:
  - apply creative thinking techniques to originate ideas and concepts
  - generate a range of ideas and options for visually representing a concept, idea or brief
  - develop 2-D designs that best respond to specifications
- learning skills to:
  - keep informed of new creative approaches, techniques, materials and equipment relevant to 2-D design
  - improve own skills in developing 2-D designs through practice and responding to feedback from others on own work
- literacy skills to interpret specifications and briefs for 2-D design
- numeracy skills to interpret and correctly apply calculations and measurements
- planning and organising skills to independently undertake the design process
- problem-solving skills to take responsibility for creating design solutions for wide-ranging and unpredictable design challenges
- self-management skills to manage own work and adopt a professional work ethic
- technical skills to develop 2-D designs using a range of techniques and approaches appropriate to the brief or idea

### Required knowledge

- ways in which 2-D designs are used in the particular area of work
- principles of 2-D design
- physical properties and capabilities of the range of equipment, tools and materials used for 2-D design
- ways to present finished 2-D designs
- work space requirements for the production of 2-D design, including set-up of work space for particular types of 2-D work
- issues and challenges that arise in the context of making 2-D designs
- intellectual property issues and legislation associated with making 2-D designs
- sustainability issues associated with equipment, tools and materials used in 2-D design
- organisational and legislative OHS procedures in relation to design

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• originate concepts for 2-D design that address the brief</li> <li>• develop effective 2-D designs and design processes that meet project requirements and provide creative solutions</li> <li>• apply professional practice to 2-D design work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• projects, tools, space and equipment required for developing 2-D designs in the relevant area of work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• practical demonstration of skills using required resources to develop 2-D designs</li> <li>• direct observation of the development of 2-D designs by the candidate</li> <li>• evaluation of 2-D designs produced by the candidate</li> <li>• oral or written questioning to assess knowledge of 2-D design techniques</li> <li>• review of portfolios of evidence</li> </ul>

	<ul style="list-style-type: none"> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Specifications</b> may include:	<ul style="list-style-type: none"> <li>• background information about clients</li> <li>• budget</li> <li>• clients' needs</li> <li>• creative objectives</li> <li>• considerations, such as: <ul style="list-style-type: none"> <li>• contractual</li> <li>• copyright</li> <li>• ethical</li> <li>• legal</li> </ul> </li> <li>• diagrams indicating, for example: <ul style="list-style-type: none"> <li>• colours</li> <li>• measurements</li> <li>• scale</li> <li>• style</li> </ul> </li> <li>• materials</li> <li>• personal intent</li> <li>• personnel involved in the project</li> <li>• purpose</li> <li>• relevant statutory requirements, e.g. health and safety considerations</li> <li>• requirements for development or building consent</li> <li>• scope for making adjustments</li> <li>• sponsorship</li> </ul>
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	<ul style="list-style-type: none"> <li>• technical objectives</li> <li>• technology</li> <li>• timeframe</li> <li>• visual representations.</li> </ul>
<b>Resources</b> may include:	<ul style="list-style-type: none"> <li>• equipment, such as: <ul style="list-style-type: none"> <li>• cutting blades</li> <li>• digital equipment</li> <li>• measuring tools</li> <li>• pens and nibs</li> <li>• range of brushes, including air brushes</li> <li>• receptacles</li> <li>• rulers</li> <li>• scissors</li> <li>• spatulas</li> <li>• sponges</li> <li>• spray guns</li> </ul> </li> <li>• materials, such as: <ul style="list-style-type: none"> <li>• cardboard</li> <li>• charcoal</li> <li>• clays</li> <li>• coloured pencils</li> <li>• crayons</li> <li>• extenders and binders</li> <li>• fibreglass</li> <li>• foamcore</li> <li>• inks</li> <li>• laminates</li> <li>• latex</li> <li>• nails</li> <li>• natural and synthetic fibres</li> <li>• paper</li> <li>• paper pulp</li> <li>• pastels</li> <li>• perspex</li> <li>• polystyrene</li> <li>• resins</li> <li>• rubber</li> <li>• solvents and cleaning materials</li> <li>• specialised metal and wood primers</li> <li>• tape</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• turps</li> <li>• water and oil-based paints</li> <li>• waterproof lacquers</li> <li>• relevant software</li> <li>• time.</li> </ul>
<b><i>Design processes may include:</i></b>	<ul style="list-style-type: none"> <li>• applying elements and principles of design</li> <li>• assessing various materials, equipment and software</li> <li>• developing inspiration boards, storyboards and other draft visuals</li> <li>• identifying, classifying and selecting constraints</li> <li>• manipulating design variables to satisfy the non-negotiable constraints and optimising those that are negotiable.</li> </ul>
<b><i>Design language refers to:</i></b>	<ul style="list-style-type: none"> <li>• overarching scheme or style that guides the design of a complement of products.</li> </ul>
<b><i>Key people may include:</i></b>	<ul style="list-style-type: none"> <li>• art department</li> <li>• audience</li> <li>• client</li> <li>• creative director</li> <li>• designer</li> <li>• director</li> <li>• manager</li> <li>• mentor</li> <li>• other technical and specialist personnel</li> <li>• producer</li> <li>• production manager</li> <li>• project manager</li> <li>• representative of organisation commissioning the work</li> <li>• supervisor</li> <li>• teacher</li> <li>• technical director.</li> </ul>
<b><i>Professional work ethic may include:</i></b>	<ul style="list-style-type: none"> <li>• attentive behaviour in creative practice</li> <li>• following organisational and industry storage and inventory procedures</li> <li>• following organisational, industry and legislative OHS procedures</li> <li>• punctuality and reliability</li> <li>• responding appropriately to feedback</li> <li>• working creatively with individual differences.</li> </ul>

## **Unit Sector(s)**

Visual communication – art, craft and design

## CUVACD507A Refine 3-D design ideas and processes

### Modification History

Version	Comments
CUVACD507A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to extend and deepen engagement with three-dimensional (3-D) design ideas and processes for the production of work at a professional level.

### Application of the Unit

Designers and artists engage with a wide and potentially complex range of ideas about 3-D design. At this level they are able to then develop and refine their own ideas and responses to the potential of the 3-D form through the production of professional work.

This unit complements units that focus on specialised skills for particular design disciplines or art forms.

Work may be independent or collaborative. It is largely self-directed with guidance and mentoring available as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Originate ideas for 3-D design	<p>1.1 Generate ideas for design concepts through research, exploration and experimentation</p> <p>1.2 Develop initial design concepts consistent with the intent of the work or <b><i>specifications</i></b> of the brief</p> <p>1.3 Evaluate, explore and play with options and <b><i>materials</i></b> that best suit the design brief</p> <p>1.4 Refine options and select the approach that best meets design brief requirements</p>
2. Plan design process	<p>2.1 Develop clear plan and schedule for design realisation</p> <p>2.2 Organise and allocate resources to meet required standards, timeframes and budget</p> <p>2.3 Liaise with others involved in design realisation as required</p> <p>2.4 Monitor process to ensure integrity of design is maintained, including challenging own design work</p> <p>2.5 Identify difficulties or problems and take action to rectify</p> <p>2.6 Maintain accurate, relevant and complete documentation</p>
3. Refine and consolidate process	<p>3.1 Develop effective 3-D designs and <b><i>design processes</i></b></p> <p>3.2 Develop and document a <b><i>design language</i></b> that reflects own style and approach</p> <p>3.3 Identify opportunities for refinement and re-thinking and make adjustments as required</p> <p>3.4 Articulate the design process and the final solution through effective documentation of work</p>

	3.5 Prepare and present 3-D design solutions to <i>key people</i>
4. Maintain expertise	<p>4.1 Apply <i>professional work ethic</i> to design activities</p> <p>4.2 Use feedback from others to improve own skills in design</p> <p>4.3 Stay up-to-date with industry standards and seek opportunities to further develop technical and conceptual skills</p> <p>4.4 Source new ideas and trends through regular review of the work of others</p> <p>4.5 Keep informed about new creative approaches, techniques, materials and equipment for 3-D design</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to:
  - work collaboratively in the design process
  - create design documentation
- initiative and enterprise skills to:
  - apply creative thinking techniques to originate ideas and concepts
  - generate a range of ideas and options for visually representing a concept, idea or brief
  - develop 3-D designs that best respond to specifications
- learning skills to:
  - keep informed of new creative approaches, techniques, materials and equipment relevant to 3-D design
  - improve own skills in developing 3-D designs through practice and responding to feedback from others on own work
- literacy skills to interpret specifications and briefs for 3-D design
- numeracy skills to interpret and correctly apply calculations and measurements
- planning and organising skills to independently undertake the design process
- problem-solving skills to take responsibility for creating design solutions for wide-ranging and unpredictable design challenges
- self-management skills to manage own work and adopt a professional work ethic
- technical skills to develop 3-D designs using a range of techniques and approaches appropriate to the brief or idea

### Required knowledge

- ways in which 3-D designs are used in the particular area of work
- principles of 3-D design
- physical properties and capabilities of the range of materials, tools and equipment used for 3-D design
- ways to present finished 3-D designs
- work space requirements for the production of 3-D design, including set-up of work space for particular types of 3-D work
- issues and challenges that arise in the context of making 3-D designs
- intellectual property issues and legislation associated with making 3-D designs
- sustainability issues associated with materials, tools and equipment used in 3-D design
- organisational and legislative OHS procedures in relation to design

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• originate a concept for 3-D design that meet the needs of the brief</li> <li>• develop effective 3-D designs and design processes that meet project requirements and provide creative solutions</li> <li>• apply professional practice to 3-D design work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• projects, tools, space and equipment required for developing 3-D designs in the relevant area of work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• practical demonstration of skills using required resources to develop 3-D designs</li> <li>• direct observation of the development of 3-D designs by the candidate</li> <li>• evaluation of 3-D designs produced by the candidate</li> <li>• oral or written questioning to assess knowledge of 3-D design techniques</li> <li>• review of portfolios of evidence</li> </ul>

	<ul style="list-style-type: none"> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Specifications</b> may include:	<ul style="list-style-type: none"> <li>• background information about clients</li> <li>• budget</li> <li>• clients' needs</li> <li>• creative objectives</li> <li>• considerations, such as:             <ul style="list-style-type: none"> <li>• contractual</li> <li>• ethical</li> <li>• legal</li> </ul> </li> <li>• diagrams indicating, for example:             <ul style="list-style-type: none"> <li>• colours</li> <li>• measurements</li> <li>• scale</li> <li>• style</li> </ul> </li> <li>• materials</li> <li>• personal intent</li> <li>• personnel involved in the project</li> <li>• purpose</li> <li>• relevant statutory requirements, e.g. health and safety considerations</li> <li>• requirements for development or building consent</li> <li>• scope for making adjustments</li> <li>• sponsorship</li> <li>• technical objectives</li> </ul>
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	<ul style="list-style-type: none"> <li>• technology</li> <li>• timeframe</li> <li>• visual representations.</li> </ul>
<b>Materials</b> may include:	<ul style="list-style-type: none"> <li>• clays</li> <li>• drawing and illustration materials, such as pencils, crayons, pastels, inks, charcoal and paints</li> <li>• fasteners, such as nails, screws, hooks and bolts</li> <li>• found objects and materials</li> <li>• glass</li> <li>• lacquers</li> <li>• laminates</li> <li>• latex</li> <li>• manufactured plastics, such as: <ul style="list-style-type: none"> <li>• fibreglass</li> <li>• polyurethane and polyester resins</li> <li>• sheet plastics</li> <li>• silicones</li> <li>• thermoset and thermoplastic elastomers</li> </ul> </li> <li>• materials to represent particular surfaces, such as rock, earth and water</li> <li>• materials for cleaning, priming and finishing, such as: <ul style="list-style-type: none"> <li>• extenders and binders</li> <li>• specialised primers</li> <li>• water and oil-based paints</li> </ul> </li> <li>• metals, such as: <ul style="list-style-type: none"> <li>• metal wire</li> <li>• sheet metal</li> </ul> </li> <li>• natural and synthetic fibres</li> <li>• paper pulp</li> <li>• plaster products, such as: <ul style="list-style-type: none"> <li>• Forton MG</li> <li>• gypsum cement</li> <li>• pottery plaster and dental plaster</li> </ul> </li> <li>• recycled materials</li> <li>• sheet materials, such as: <ul style="list-style-type: none"> <li>• cardboard</li> <li>• foamcore</li> <li>• paper</li> <li>• perspex and other plastic sheet materials</li> <li>• polystyrene</li> <li>• sheet metal</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• string</li> <li>• tape</li> <li>• waxes, such as: <ul style="list-style-type: none"> <li>• jewellery wax</li> <li>• microcrystalline wax</li> </ul> </li> <li>• wood and timber products, such as: <ul style="list-style-type: none"> <li>• balsa wood</li> <li>• MDF board</li> <li>• wooden skewers</li> </ul> </li> </ul>
<b><i>Design processes</i></b> may include:	<ul style="list-style-type: none"> <li>• applying elements and principles of design</li> <li>• assessing various materials, equipment and software</li> <li>• developing inspiration boards, storyboards and other draft visuals</li> <li>• identifying, classifying and selecting constraints</li> <li>• manipulating design variables to satisfy the non-negotiable constraints and optimising those that are negotiable.</li> </ul>
<b><i>Design language</i></b> refers to:	<ul style="list-style-type: none"> <li>• overarching scheme or style that guides the design of a complement of products.</li> </ul>
<b><i>Key people</i></b> may include:	<ul style="list-style-type: none"> <li>• art department</li> <li>• audience</li> <li>• client</li> <li>• creative director</li> <li>• designer</li> <li>• director</li> <li>• manager</li> <li>• mentor</li> <li>• other technical and specialist personnel</li> <li>• producer</li> <li>• production manager</li> <li>• project manager</li> <li>• representative of organisation commissioning the work</li> <li>• supervisor</li> <li>• teacher</li> <li>• technical director.</li> </ul>
<b><i>Professional work ethic</i></b> may include:	<ul style="list-style-type: none"> <li>• attentive behaviour in creative practice</li> <li>• following organisational and industry storage and inventory procedures</li> <li>• following organisational, industry and legislative OHS procedures</li> <li>• punctuality and reliability</li> <li>• responding appropriately to feedback</li> </ul>

	<ul style="list-style-type: none"><li>• working creatively with individual differences.</li></ul>
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## Unit Sector(s)

Visual communication – art, craft and design

## CUVACD512A Work with photomedia in creative practice

### Modification History

Version	Comments
CUVACD512A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to work with any type of photomedia in professional creative practice.

### Application of the Unit

Professional artists and designers working in many media and disciplines engage with photomedia in different ways, depending on the needs of their practice.

Photomedia may be used as a vehicle for the creative presentation or documentation of work, or could be a finished work in its own right, either as a whole work or part of a work. It may include still images, film, video, music or interactive content.

At this level, the practitioner works independently with mentoring and guidance as required.

This unit does not address the specialised skills needed by photo imaging professionals.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Explore the potential of photomedia in own work	1.1 Research the potential of <b><i>photomedia</i></b> in own work using appropriate <b><i>sources of information</i></b> 1.2 Reference traditional and contemporary approaches to the use of photomedia 1.3 Identify relevant <b><i>technologies</i></b> and approaches for the development of photomedia projects 1.4 Develop ideas for work through investigation, exploration, discussion and review
2. Experiment with photomedia	2.1 Confirm a command of the basic technical features and capabilities of chosen technologies 2.2 Explore and experiment with particular features of specific technologies, including the potential of combining technologies for particular purposes 2.3 Achieve different effects by extending the capabilities of photomedia technologies 2.4 Refine ideas through a process of experimentation
3. Create and present finished photomedia work	3.1 Fulfil work objectives through manipulation of technologies with increasing skill and confidence 3.2 Challenge and test technical and conceptual aspects of the work during the development process 3.3 Complete technical requirements for integration of photomedia with other media 3.4 Finalise images and files using appropriate protocols

	3.5 Apply safe work practices for chosen photomedia technologies
4. Evaluate work	<p>4.1 Review work in progress in the context of personal, professional and artistic objectives</p> <p>4.2 Identify and respond to <b><i>opportunities for refinement and re-thinking</i></b></p> <p>4.3 Evaluate the work process in terms of its <b><i>efficiency and effectiveness</i></b></p> <p>4.4 Evaluate finished work in terms of its <b><i>coherence with the project concept</i></b>, technical resolution and suitability for the intended purpose</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to discuss abstract and complex ideas with others
- critical thinking skills to:
  - compare contemporary styles and conceptual/aesthetic approaches to photomedia
  - employ reflective questioning to analyse own work
- literacy skills to interpret technical information associated with different technologies
- numeracy skills to work with technical features of photomedia technologies
- problem-solving skills to solve technical and conceptual challenge in photomedia projects
- learning and self-management skills to review own work to inform professional development
- planning and organising skills to organise equipment and work processes
- technology skills to work with advanced features of photomedia technologies

### Required knowledge

- range of traditional, current and emerging options for the use of photomedia in the context of creative practice
- traditional and contemporary issues that inform the use of photomedia in creative practice
- intellectual property issues and legislation that affect the use of photomedia
- sustainability issues associated with photomedia materials, tools and equipment
- OHS requirements for working with photomedia

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• produce a coherent body of photomedia work using well-developed conceptual and technical skills</li> <li>• research traditional and contemporary photomedia options for application to own work</li> <li>• apply safe work practices for the technologies being used.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• a range of photomedia technologies as required by the creative work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of work in progress, including exploration of, and experimentation with, techniques</li> <li>• evaluation of technical proficiency within a body of work produced by the candidate</li> <li>• evaluation of processes used by the candidate to evolve and refine photomedia projects</li> <li>• evaluation of the work documentation</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Photomedia</i></b> opportunities may relate to:	<ul style="list-style-type: none"> <li>• documentation of own work</li> <li>• integration in own work</li> <li>• presentation of own work</li> <li>• a complete work or part of a work, including:               <ul style="list-style-type: none"> <li>• moving images</li> <li>• still images</li> <li>• time-based art.</li> </ul> </li> </ul>
<b><i>Sources of information</i></b> may include:	<ul style="list-style-type: none"> <li>• critical works</li> <li>• discussions with innovative industry practitioners</li> <li>• electronic or print media</li> <li>• exhibitions</li> <li>• industry associations</li> <li>• internet and podcasts</li> <li>• libraries and archives</li> <li>• lifestyle and contemporary issues magazines</li> <li>• museums</li> <li>• personal observations and experience</li> <li>• technical publications</li> <li>• work of other artists.</li> </ul>
<b><i>Technologies</i></b> may include:	<ul style="list-style-type: none"> <li>• digital</li> <li>• experimental</li> <li>• traditional.</li> </ul>
<b><i>Opportunities for refinement and re-thinking</i></b> may relate to:	<ul style="list-style-type: none"> <li>• collaboration</li> <li>• ideas</li> <li>• materials</li> <li>• processes</li> <li>• techniques</li> <li>• workflow.</li> </ul>
<b><i>Efficiency and effectiveness</i></b> may relate to:	<ul style="list-style-type: none"> <li>• completion on time</li> <li>• completion on budget</li> <li>• positive or negative impact on own health</li> <li>• quality of the work</li> <li>• success in communicating ideas</li> <li>• technical standard of work.</li> </ul>

<i>Coherence with the project concept</i> may relate to:	<ul style="list-style-type: none"><li>• connections within the work</li><li>• connections or divergence between initial concept and final product</li><li>• materials</li><li>• processes</li><li>• techniques.</li></ul>
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## Unit Sector(s)

Visual communication – art, craft and design

## CUVACD601A Extend professional expertise with drawing and other visual representation tools

### Modification History

Version	Comments
CUVACD601A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to extend skills with drawing and other forms of visual representation to develop a personal approach or style suited to the individual's professional practice.

### Application of the Unit

Creative practitioners working independently apply the skills and knowledge in this unit. They draw on high-level cognitive and creative skills to evolve and refine personalised approaches to visual representation to support their professional practice.

This activity is self-directed.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Element	Performance Criteria
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*Elements describe the essential outcomes of a unit of competency.*

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Evolve technical skills and other visual representation tools	<p>1.1 Evolve expertise through ongoing experimentation with <b><i>different tools and media</i></b></p> <p>1.2 Deepen drawing technique and confidence through practice with tone, layout, perspective, colour and imagery</p> <p>1.3 Evaluate own drawing expertise against <b><i>professional needs and aspirations</i></b></p>
2. Refine drawing and representational skills as visual-thinking tools	<p>2.1 Extend drawing as a visual research tool in the development of work</p> <p>2.2 Harmonise <b><i>research, thinking and analysis</i></b> through the drawing process</p> <p>2.3 Analyse drawing as visual thinking in own work</p>
3. Develop personalised style to support professional practice	<p>3.1 Develop a <b><i>personalised style</i></b> that supports and reflects the unique nature of own work and practice</p> <p>3.2 Evaluate the ways in which drawing contributes to a successful professional practice</p> <p>3.3 Discuss and explore drawing processes and challenges with others</p> <p>3.4 Challenge, adapt and refine own style to meet new and <b><i>changing contexts for work</i></b></p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to discuss and explore complex and abstract ideas with others
- critical thinking and analytical skills to analyse the drawing work of others and use drawing as a visual research tool
- initiative and enterprise skills to research and identify opportunities for drawing in own practice
- learning and self-management skills to recognise and use drawing as a professional development tool
- problem-solving skills to adapt and challenge own practice in the light of experience
- technical skills to use an extended range of drawing techniques, materials and tools

### Required knowledge

- industry expectations and standards for professional practitioners in relation to visually representing ideas
- techniques and devices to extend expertise in drawing and visual representation
- physical properties and capabilities of a wide range of materials and tools used in drawing
- intellectual property issues and legislation in relation to drawing and visual representation
- OHS issues associated with the tools and materials used for drawing and visual representation

### Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• develop a personalised style of drawing or visual representation that supports and reflects the individual's professional creative work</li> <li>• extend expertise through ongoing practice with different techniques and media.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• drawing materials, tools and equipment.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p>



	<ul style="list-style-type: none"> <li>• evaluation of the processes of drawing and visual representation used by the candidate</li> <li>• evaluation of completed drawings prepared by the candidate and their relationship to completed artwork</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Different tools and media</i></b> may include:	<ul style="list-style-type: none"> <li>• black and white media</li> <li>• charcoal</li> <li>• coloured media</li> <li>• conte</li> <li>• digital media</li> <li>• gouache</li> <li>• ink</li> <li>• modelling</li> <li>• paint</li> <li>• pastel, including oil pastel</li> <li>• pencil</li> <li>• watercolour.</li> </ul>
<b><i>Professional needs and aspirations</i></b> may relate to:	<ul style="list-style-type: none"> <li>• own interactions with the drawing process</li> <li>• specific value of drawing to particular areas of professional practice</li> <li>• ways work needs to be presented and promoted.</li> </ul>

<b><i>Research, thinking and analysis</i></b> may involve:	<ul style="list-style-type: none"><li>• challenging preconceptions</li><li>• examining own motivations</li><li>• making connections and associations</li><li>• questioning assumptions</li><li>• referencing the work of others.</li></ul>
<b><i>Personalised style</i></b> is one which:	<ul style="list-style-type: none"><li>• is based on the outcomes of own research and experimentation</li><li>• reflects and supports a professional practice in chosen area of work.</li></ul>
<b><i>Changing contexts for work</i></b> may relate to:	<ul style="list-style-type: none"><li>• evolving personal ideas</li><li>• industry trends</li><li>• market trends</li><li>• opportunities for work in different industries</li><li>• tools and technologies.</li></ul>

## Unit Sector(s)

Visual communication – art, craft and design

# CUVDES403A Research and apply techniques for the design of wearable objects

## Modification History

Version	Comments
CUVDES403A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

## Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to research and apply techniques for the design of wearable objects. It involves interpreting work briefs, organising resources, testing ideas, and refining approaches to a range of design challenges. The unit covers the design process to the point of producing prototypes of wearable objects.

## Application of the Unit

Individuals who generate design ideas and solutions for wearable objects, such as fashion accessories and clothing, costumes, footwear, millinery and jewellery, apply the skills and knowledge in this unit.

Skills associated with producing the final wearable objects can be found in units related to specific disciplines, e.g. making costumes or jewellery. These units can be found elsewhere in CUV11 Visual Arts, Craft and Design Training Package, or in other Training Packages such as CUF07 Screen and Media or LMT07 Textiles, Clothing and Footwear.

At this level, research, experimentation and ongoing refinement are used to produce a range of design work where an individual is beginning the process of finding an individual style. Work is undertaken independently with supervision and guidance as required.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Interpret briefs for the design of wearable objects	1.1 Interpret the <b><i>specifications</i></b> of design <b><i>briefs</i></b> 1.2 Take user or client requirements into account when making decisions about designing <b><i>wearable objects</i></b> 1.3 Clarify issues about specifications, <b><i>parameters and constraints</i></b> with <b><i>relevant people</i></b> as required 1.4 Research and evaluate <b><i>information</i></b> pertinent to briefs
2. Organise resources	2.1 Identify resources required to develop prototypes of wearable objects, including <b><i>work space, materials, tools and equipment</i></b> 2.2 Prepare and care for resources according to requirements 2.3 Follow storage and inventory procedures
3. Test design approaches for wearable objects	3.1 Produce <b><i>preliminary visual representations</i></b> 3.2 Identify possible <b><i>approaches</i></b> and establish <b><i>criteria</i></b> for selecting final approach 3.3 Select appropriate materials, tools and equipment and <b><i>test approaches and techniques</i></b> 3.4 Evaluate testing processes against criteria and select the approach that best meets the requirements of briefs 3.5 Critique own work and seek feedback as required 3.6 <b><i>Refine and document the design approach</i></b> based on testing and

	evaluation
4. Make prototypes of wearable objects	<p>4.1 Evaluate the need for object fabrication and the scope of work required</p> <p>4.2 Select and organise materials, tools and equipment for fabrication according to design approach</p> <p>4.3 Make the prototype or sample ensuring consistency with design concepts and briefs</p> <p>4.4 Respond positively to feedback and refine work as required</p> <p>4.5 Present prototypes within agreed timeframes</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to engage with others about approaches to the design of wearable objects
- initiative and enterprise skills to experiment with techniques to produce effects that enhance wearable objects
- learning skills to refine and improve a range of techniques
- literacy skills to:
  - interpret design briefs
  - research information to support graphic design work
- numeracy skills to:
  - calculate costs and quantities
  - take measurements
- self-management and planning skills to plan work tasks
- technical skills to evaluate, adapt and integrate a range of techniques into the design and prototyping of wearable objects

### Required knowledge

- role of experimentation in the design process
- work and ideas of other designers of wearable objects
- formal elements and principles of design and their application to the design of wearable objects
- techniques, materials, tools and equipment and their application to designing and making wearable objects
- capabilities of different types of equipment used in the manufacture of wearable objects
- common formats and features of briefs relating to the design of wearable objects

- history and theory of design in relation to the design of wearable objects
- intellectual property issues and legislation and their relevance to the design of wearable objects
- sustainability considerations for wearable object design
- OHS requirements relevant to the design of wearable objects

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• test and use a range of approaches and techniques for the design of wearable objects in response to the requirements of a brief</li> <li>• produce a prototype of at least one wearable object</li> <li>• apply knowledge of processes and techniques used to design wearable objects.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• briefs on which to base the design of wearable objects</li> <li>• equipment and tools used to produce prototypes of wearable objects.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of design or prototyping work in progress, including exploration of, and experimentation with, techniques</li> <li>• evaluation of objects designed by the candidate</li> <li>• questioning and discussion about the candidate's intentions and the work outcome</li> <li>• review of visual documentation for wearable objects</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote</p>

	communities and those with interrupted schooling).
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBDES401A Generate design solutions</li> <li>• BSBDES402A Interpret and respond to a design brief.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Specifications</i></b> may refer to:	<ul style="list-style-type: none"> <li>• medium</li> <li>• purpose</li> <li>• style</li> <li>• target group.</li> </ul>
<b><i>Briefs</i></b> are usually prepared by a commissioning body or organisation and may be:	<ul style="list-style-type: none"> <li>• diagrammatic</li> <li>• verbal</li> <li>• visual</li> <li>• written.</li> </ul>
<b><i>Wearable objects</i></b> may include:	<ul style="list-style-type: none"> <li>• accessories</li> <li>• costumes</li> <li>• fashion clothing</li> <li>• footwear</li> <li>• jewellery</li> <li>• millinery.</li> </ul>
<b><i>Parameters and constraints</i></b> may refer to:	<ul style="list-style-type: none"> <li>• budgeting and financing requirements</li> <li>• cost of production</li> <li>• number of items</li> <li>• outlets</li> <li>• timeframes.</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• clients</li> <li>• colleagues</li> <li>• industry practitioners</li> <li>• managers</li> <li>• mentors</li> <li>• supervisors.</li> </ul>

<b>Information</b> may be about:	<ul style="list-style-type: none"> <li>• design standards</li> <li>• health and safety</li> <li>• industry standards</li> <li>• considerations, such as: <ul style="list-style-type: none"> <li>• contractual</li> <li>• copyright</li> <li>• ethical</li> <li>• legal</li> <li>• technology</li> </ul> </li> <li>• material characteristics and capabilities.</li> </ul>
<b>Work space</b> needs may include:	<ul style="list-style-type: none"> <li>• dry and wet areas</li> <li>• dust extraction</li> <li>• lighting</li> <li>• process-specific space needs</li> <li>• ventilation.</li> </ul>
<b>Materials</b> may include:	<ul style="list-style-type: none"> <li>• acrylic</li> <li>• cardboard</li> <li>• dyes</li> <li>• fabric</li> <li>• felt</li> <li>• fibre</li> <li>• found objects</li> <li>• inks</li> <li>• latex</li> <li>• leather</li> <li>• metal</li> <li>• paints</li> <li>• paper</li> <li>• plastics</li> <li>• pulp</li> <li>• rubber</li> <li>• spun fibre</li> <li>• stones</li> <li>• straw</li> <li>• wire</li> <li>• wood.</li> </ul>
<b>Tools and equipment</b> relate to requirements for dressmaking, shoemaking and leatherwork, millinery	<ul style="list-style-type: none"> <li>• blocks</li> <li>• hand tools</li> <li>• lasts</li> <li>• leather-working tools</li> <li>• metal-working tools</li> </ul>



and jewellery making, and include:	<ul style="list-style-type: none"> <li>• painting and dying equipment</li> <li>• sewing machines for fabric and leather</li> <li>• weaving equipment</li> <li>• woodworking tools.</li> </ul>
<b>Preliminary visual representations</b> may involve:	<ul style="list-style-type: none"> <li>• computer-aided drawing</li> <li>• mock-up</li> <li>• sketching.</li> </ul>
<b>Approaches</b> may include:	<ul style="list-style-type: none"> <li>• aesthetic considerations</li> <li>• choice of medium and materials</li> <li>• design solutions</li> <li>• parameters of the brief.</li> </ul>
<b>Criteria</b> may relate to:	<ul style="list-style-type: none"> <li>• access to materials, tools and equipment required to make objects</li> <li>• access to specialist fabricators</li> <li>• consistency with briefs for wearable objects</li> <li>• ease of manufacture</li> <li>• personal affinity with medium and materials.</li> </ul>
Strategies to <b>test</b> techniques may involve:	<ul style="list-style-type: none"> <li>• exploring techniques by making practice pieces, test pieces, mock-ups or samples</li> <li>• testing materials by applying stress tests and colour tests.</li> </ul>
<b>Techniques</b> may include:	<ul style="list-style-type: none"> <li>• bottoming</li> <li>• casting</li> <li>• crimping</li> <li>• dying</li> <li>• embellishing</li> <li>• embossing</li> <li>• engraving</li> <li>• etching</li> <li>• finishing</li> <li>• in-seaming</li> <li>• knitting</li> <li>• knotting</li> <li>• lasting</li> <li>• leatherwork</li> <li>• metalwork</li> <li>• millinery stitching</li> <li>• painting</li> <li>• printing</li> <li>• sewing</li> <li>• stitching</li> <li>• stone setting</li> </ul>

	<ul style="list-style-type: none"> <li>• straw and felt blocking</li> <li>• trimming</li> <li>• weaving.</li> </ul>
Process to <i>refine</i> design approach may involve:	<ul style="list-style-type: none"> <li>• adjustment to design and design considerations</li> <li>• adjustment to use the extended capabilities of the techniques.</li> </ul>
Process used to <i>document the design approach</i> may involve:	<ul style="list-style-type: none"> <li>• final drawings</li> <li>• illustrations</li> <li>• material samples</li> <li>• models</li> <li>• photographs</li> <li>• specifications for fabrication</li> <li>• written rationale or description.</li> </ul>

## Unit Sector(s)

Design – design process

# CUVDIG401A Experiment with techniques to enhance digital images

## Modification History

Version	Comments
CUVDIG401A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

## Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to proactively experiment and innovate with various digital imaging techniques and ideas to develop an individual style or voice.

## Application of the Unit

People with a command of digital techniques apply the skills and knowledge outlined in this unit. They could be producing digital images for electronic media or physical output.

At this level, work is undertaken independently with supervision and guidance as required.

## Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

### Performance Criteria

*Elements describe the essential outcomes      Performance criteria describe the*

of a unit of competency.

performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1. Develop proficiency with a range of digital imaging techniques and media	<p>1.1. Evaluate the potential for new approaches to digital imaging based on capabilities of <b>techniques</b> already used</p> <p>1.2. Adapt or introduce new tools, <b>equipment</b> and <b>materials</b> to achieve different effects</p> <p>1.3. Extend the capabilities of digital imaging techniques through experimentation</p> <p>1.4. Take account of the <b>safety and sustainability considerations</b> for different techniques and media</p>
2. Develop ideas for digital imaging	<p>2.1. Articulate creative and other goals for digital image work</p> <p>2.2. <b>Research</b>, adapt and use relevant <b>ideas</b> and approaches from other practitioners with consideration of <b>intellectual property requirements</b></p> <p>2.3. Apply knowledge of different digital imaging techniques to inform ideas</p> <p>2.4. Allow techniques and ideas to work together to inform each other</p> <p>2.5. Consider the <b>professional potential</b> and <b>other criteria</b> for work when developing ideas</p> <p>2.6. <b>Refine</b> and confirm ideas based on experimentation, research and collaboration with others</p>
3. Organise digital imaging resources	<p>3.1. Assess specific resource requirements for the chosen work</p> <p>3.2. Research and access potential <b>sources of supply</b> for digital imaging resources</p> <p>3.3. Evaluate <b>cost and other constraints</b> that impact on the development of work</p> <p>3.4. Evaluate and respond to <b>presentation considerations</b> for finished digital images</p> <p>3.5. Set up or coordinate resource requirements according to</p>

	safety and other workplace requirements
4. Create finished digital images	<p>4.1. Create digital images, using techniques and media selected from research and experimentation</p> <p>4.2. Review and refine ideas and approaches based on ongoing experience with the production of work</p> <p>4.3. Use safe and sustainable work practices throughout the production of work</p> <p>4.4. Document and record the development of the work and the research and ideas that inform it</p>
5. Evaluate own digital imaging work	<p>5.1. Reflect on own work in terms of conceptual development and technical execution</p> <p>5.2. Identify areas for future improvement especially in terms of own skill development</p> <p>5.3. Discuss completed work with others and respond positively to feedback</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to:
  - discuss ideas and techniques in own work
  - create a record of the digital imaging work
- initiative and enterprise skills to:
  - experiment with digital imaging techniques to enhance final digital images
  - apply critical thinking and analytical skills when developing ideas for digital imaging
- learning skills to:
  - refine and improve a range of techniques
  - evaluate quality of own work and identify ways to enhance own practice
- literacy skills to undertake research about the work of other digital imaging artists and arts practitioners
- numeracy skills to:
  - evaluate resource costs
  - calculate material requirements
- planning and organising skills to plan work tasks and resources

- problem-solving skills to identify and resolve technical and conceptual issues in digital imaging work
- technology skills to use the internet as a research tool.

### Required knowledge

- role of experimentation in developing and refining ideas for digital imaging and how this relates to the development of an individual style or voice
- ways to adapt, extend and combine the capabilities of a wide range of digital imaging technologies and techniques
- characteristics of different materials under different treatments and the potential of these characteristics to achieve different effects in work
- formal elements and principles of design and how they may be used, adapted and challenged in digital imaging work
- research methodologies used by artists
- historical and theoretical contexts for digital imaging and how they may be used to inform individual practice
- sources of raw, part-processed and processed digital imaging materials
- sources of other resources needed in a professional digital imaging practice
- intellectual property issues and legislation to be considered by independent arts practitioners
- sustainability considerations for the professional operation of a digital imaging practice
- OHS requirements for the set-up and operation of digital imaging work space.

### Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Evidence of the ability to: <ul style="list-style-type: none"><li>• develop ideas and techniques through a process of research and experimentation</li><li>• produce a series of digital images or single major work that demonstrates a command of techniques</li><li>• apply knowledge of digital imaging techniques, equipment and materials and the ways they may be adapted and combined.</li></ul>
<b>Context of and specific resources for</b>	Assessment must ensure access to: <ul style="list-style-type: none"><li>• equipment and materials used in digital imaging work.</li></ul>

<b>assessment</b>	
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of technical execution of work pieces produced by the candidate</li> <li>• direct observation of digital imaging in progress, including exploration of, and experimentation with, techniques</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP401A Realise a creative project</li> <li>• ICPPP430C Manage colour.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• acquiring images:             <ul style="list-style-type: none"> <li>• from the internet</li> <li>• through digital photography</li> <li>• through scanning</li> </ul> </li> <li>• manipulating images using the full range of features in industry-standard digital imaging software</li> <li>• matching resolution and format of output to reproduction</li> </ul>
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	<ul style="list-style-type: none"> <li>requirements</li> <li>outputting image as: <ul style="list-style-type: none"> <li>a print</li> <li>CD</li> <li>other storage medium</li> </ul> </li> <li>uploading images to the internet.</li> </ul>
<b>Equipment</b> may include:	<ul style="list-style-type: none"> <li>computer</li> <li>digital camera</li> <li>digital imaging software</li> <li>discs and memory cards</li> <li>guillotine</li> <li>output devices</li> <li>scanner.</li> </ul>
<b>Materials</b> may include:	<ul style="list-style-type: none"> <li>a range of printing surfaces: <ul style="list-style-type: none"> <li>papers</li> <li>acetate</li> <li>fabrics</li> </ul> </li> <li>hard copy source material, such as: <ul style="list-style-type: none"> <li>photos</li> <li>magazine clippings</li> <li>paintings.</li> </ul> </li> </ul>
<b>Safety and sustainability considerations</b> may include:	<ul style="list-style-type: none"> <li>federal, state and territory legislation, regulations and standards</li> <li>personal protection</li> <li>recycling</li> <li>safe disposal of waste.</li> </ul>
<b>Research</b> may involve:	<ul style="list-style-type: none"> <li>approaching individuals with relevant expertise</li> <li>attending lectures and talks</li> <li>conducting material and technical experiments and tests</li> <li>seeking out information in books, journals and newspapers</li> <li>searching the internet</li> <li>visiting exhibitions and museums.</li> </ul>
<b>Ideas</b> may be influenced by:	<ul style="list-style-type: none"> <li>artistic aspirations</li> <li>current capability with techniques</li> <li>historical and theoretical contexts</li> <li>subject matter or theme for the work, such as: <ul style="list-style-type: none"> <li>built environment</li> <li>land and place</li> <li>natural world</li> <li>political, cultural and social issues</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>• the body</li> <li>• spiritual concerns.</li> </ul>
<b>Intellectual property requirements</b> may relate to:	<ul style="list-style-type: none"> <li>• extent to which the work may be used</li> <li>• form of acknowledgement or credit</li> <li>• procedures for seeking permission to use the work of others, including systems for the administration of copyright</li> <li>• protocols for the adaptation of work by others.</li> </ul>
<b>Professional potential</b> may relate to:	<ul style="list-style-type: none"> <li>• cost of production</li> <li>• existence of an established market</li> <li>• how to promote or sell the work</li> <li>• market trends</li> <li>• professional development.</li> </ul>
<b>Other criteria</b> may relate to:	<ul style="list-style-type: none"> <li>• client and user expectations</li> <li>• environment in which work will be viewed</li> <li>• materials</li> <li>• quality of final product</li> <li>• techniques</li> <li>• timelines</li> <li>• tools.</li> </ul>
Process followed to <b>refine</b> ideas may include:	<ul style="list-style-type: none"> <li>• adjustment to consideration of elements and principles of design</li> <li>• adjustment to subject matter or theme</li> <li>• adjustment to use the extended capabilities of the technique.</li> </ul>
<b>Sources of supply</b> may include:	<ul style="list-style-type: none"> <li>• commercial outlets</li> <li>• imaging bureaux</li> <li>• internet</li> <li>• share ware</li> <li>• software resources.</li> </ul>
<b>Cost and other constraints</b> may relate to:	<ul style="list-style-type: none"> <li>• availability of materials and equipment</li> <li>• budgeting</li> <li>• sponsorship</li> <li>• timeframe.</li> </ul>
<b>Presentation considerations</b> may include:	<ul style="list-style-type: none"> <li>• availability of space and equipment</li> <li>• cost</li> <li>• practical considerations</li> <li>• presentation context</li> <li>• timeframe.</li> </ul>

## Unit Sector(s)

Visual communication – digital content and imaging

## CUVDIG501A Refine digital art techniques

### Modification History

Version	Comments
CUVDIG501A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to refine techniques in working with digital media and to develop own digital art style in a body of creative work. This occurs through a process of research, refinement and evaluation.

### Application of the Unit

Visual artists and designers whose practice includes the creation of digital media works apply the skills and knowledge in this unit. Work could be completely digital or an integration of digital and traditional media.

At this level, the practitioner has a well-developed command of digital technologies as well as the conceptual and creative skills to create a coherent body of digital work.

Technique refinement is a largely independent activity with mentoring and guidance as required. It would normally include work with several different techniques and technologies as part of the process of developing an individual style. In practice, this process is integrated with the skills described in the unit CUVPRP501A Realise a body of creative work.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Research digital media ideas and techniques	<p>1.1. Support professional practice by expanding own knowledge of historical and contemporary digital media practice</p> <p>1.2. Research ways that other artists have used different <b><i>digital media techniques</i></b></p> <p>1.3. Investigate how particular digital media techniques work to achieve different <b><i>technical effects</i></b></p> <p>1.4. Evaluate the relationships between digital media techniques and ideas</p> <p>1.5. Adapt and use relevant ideas and approaches with consideration of <b><i>intellectual property requirements</i></b></p>
2. Select digital media techniques for refinement	<p>2.1. Consider the <b><i>opportunities</i></b> offered by different digital media techniques</p> <p>2.2. Determine <b><i>limitations and constraints</i></b> of particular techniques</p> <p>2.3. Select digital media techniques for <b><i>refinement</i></b></p>
3. Consolidate digital media technique to professional level	<p>3.1. Establish and follow <b><i>safe work practices</i></b> for selected techniques</p> <p>3.2. Develop increasing confidence and skill through practice and experimentation</p> <p>3.3. Proactively identify and resolve technical problems in digital media projects based on developing expertise</p> <p>3.4. Challenge and test ideas, and allow new and unpredictable ideas to emerge</p>

	<p>3.5. Evolve ideas and other professional skills through ongoing experimentation with technique</p> <p>3.6. Develop own ways of working with techniques to create individual style</p> <p>3.7. Create a <b><i>coherent body of digital media work</i></b> that shows command of selected digital media techniques</p>
4. Evaluate own digital media technique	<p>4.1. Evaluate development of own technique with others and seek feedback</p> <p>4.2. Seek and participate in conversations that challenge and explore different concepts and approaches</p> <p>4.3. Reflect on the particular ways that experimentation with different techniques has informed own work</p> <p>4.4. Identify <b><i>ways in which technique may be further developed</i></b> as part of a professional practice and build ideas into future work</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to engage with others about the technical and conceptual aspects of digital media work
- critical thinking and analytical skills to:
  - evaluate and make judgements about relationships between digital media technique, effects and ideas
  - make critical evaluations of own digital media technique
  - make critical evaluations of research findings
- initiative and enterprise skills to identify and act on opportunities for own practice presented by research
- learning skills to develop and refine own skills to a professional practice standard
- literacy skills to analyse complex and varied information about digital media technique
- problem-solving skills to identify and resolve technical problems in digital media work
- self-management and planning skills to create a coherent body of digital media work
- technical skills to show command of chosen digital media techniques at a professional level
- technology skills to use the internet as a research tool.

### Required knowledge

- relationship between digital media technique, particular effects and ideas – in the work of other artists and in the context of own practice
- extended range of information sources that support research in digital media practice
- cultural, sociological, philosophical, aesthetic, political and commercial influences on digital media technique, in historical and contemporary contexts
- professional development opportunities for artists seeking to develop a digital media practice
- elements and principles of design and how they may be used, adapted and challenged in the creation of work
- intellectual property issues and legislation associated with digital media as a professional practice
- sustainability issues for the professional operation of a practice that includes digital media
- OHS requirements for the set-up and operation of a professional work space for digital media work.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• evolve and refine digital media technique through a demonstrated process of experimentation</li> <li>• develop individual style in own work</li> <li>• produce a coherent body of professional artwork that includes the use of well-developed digital media technique</li> <li>• research digital media technique in the broader context of other artwork and artists</li> <li>• use safe and sustainable work practices.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• equipment, materials and tools used to produce digital media work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of digital media technique within a body of work produced by the candidate</li> <li>• evaluation of processes used by the candidate to evolve</li> </ul>

	<p>and refine digital media technique</p> <ul style="list-style-type: none"> <li>• evaluation of the work documentation</li> <li>• direct observation of digital media in progress, including exploration of, and experimentation with, techniques</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP501A Realise a body of creative work.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Digital media techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• animation</li> <li>• autism</li> <li>• camera angles: <ul style="list-style-type: none"> <li>• low</li> <li>• tilted</li> <li>• aerial view</li> </ul> </li> <li>• camera movement: <ul style="list-style-type: none"> <li>• pan/dolly</li> <li>• tracking</li> <li>• zoom</li> </ul> </li> <li>• camera scales: <ul style="list-style-type: none"> <li>• close up</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>• medium shot</li> <li>• long shot</li> <li>• editing in linear and non-linear forms: <ul style="list-style-type: none"> <li>• cross-cutting</li> <li>• cutaway</li> <li>• jump cuts</li> <li>• dissolves</li> </ul> </li> <li>• mise-en-scene</li> <li>• montage</li> <li>• sound: <ul style="list-style-type: none"> <li>• direct</li> <li>• ambient</li> <li>• special effects</li> <li>• voice-overs</li> <li>• music score</li> <li>• synthesised</li> </ul> </li> <li>• techniques to accommodate different lighting and weather conditions</li> <li>• imaging conventions: <ul style="list-style-type: none"> <li>• composition</li> <li>• tone</li> <li>• balance</li> <li>• lighting.</li> </ul> </li> </ul>
<b>Technical effects</b> may include:	<ul style="list-style-type: none"> <li>• controlling and displaying time</li> <li>• imaging the passage of time</li> <li>• integrating images and other technologies</li> <li>• creating emotive content</li> <li>• making minute things visible to the naked eye</li> <li>• pictorial representation of subjects normally beyond human vision, comprehension or understanding.</li> </ul>
<b>Intellectual property requirements</b> may relate to:	<ul style="list-style-type: none"> <li>• copyright</li> <li>• design licensing regulations</li> <li>• form of acknowledgement or credit</li> <li>• moral rights</li> <li>• protocols for the adaptation of work by others</li> <li>• trademarks.</li> </ul>
<b>Opportunities</b> may include:	<ul style="list-style-type: none"> <li>• communication of ideas</li> <li>• natural affinity with particular techniques</li> <li>• potential for combining techniques</li> <li>• potential for interactions between technique and media</li> <li>• themes in work.</li> </ul>



<b><i>Limitations and constraints</i></b> may include:	<ul style="list-style-type: none"> <li>• availability of materials</li> <li>• capacity of technique to deliver required effect</li> <li>• own interaction with technique</li> <li>• resources</li> <li>• time.</li> </ul>
<b><i>Refinement</i></b> relates to:	<ul style="list-style-type: none"> <li>• ability to use technique with confidence</li> <li>• use of technique in a body of professional work.</li> </ul>
<b><i>Safe work practices</i></b> may include:	<ul style="list-style-type: none"> <li>• ergonomic safety</li> <li>• use of consumables.</li> </ul>
<b><i>Coherent body of digital media work</i></b> is:	<ul style="list-style-type: none"> <li>• conceptually resolved</li> <li>• documented in terms of its development</li> <li>• subject to critical feedback by others</li> <li>• technically resolved</li> <li>• thematically connected.</li> </ul>
<b><i>Ways in which technique may be further developed</i></b> may include:	<ul style="list-style-type: none"> <li>• collaboration</li> <li>• further study</li> <li>• intensive workshops</li> <li>• mentored guidance</li> <li>• new projects.</li> </ul>

## Unit Sector(s)

Visual communication – digital content and imaging

## CUVDRA501A Refine drawing techniques

### Modification History

Version	Comments
CUVDRA501A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to refine drawing technique and to develop own drawing style in a coherent body of creative work. This occurs through a process of research, refinement and evaluation. This unit relates to drawing as an art form and therefore differs from units that focus on drawing as a visual representation tool.

### Application of the Unit

Visual artists whose practice includes drawing apply the skills and knowledge in this unit. Drawings may be presented in a range of media and could be mixed media works.

At this level, the practitioner has a well-developed command of drawing techniques as well as the conceptual and creative skills to create a coherent body of work.

Technique refinement is a largely independent activity with mentoring and guidance as required. It would normally include work with several different techniques as part of the process of developing an individual style. In practice, this process is integrated with the skills described in the unit CUVPRP501A Realise a body of creative work.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Research drawing ideas and techniques	<p>1.1. Support professional practice by expanding own knowledge of historical and contemporary drawing practice</p> <p>1.2. Research ways that other artists have used different <b><i>drawing techniques</i></b></p> <p>1.3. Investigate how particular drawing techniques work to achieve different <b><i>technical effects</i></b></p> <p>1.4. Evaluate the relationships between drawing techniques and ideas</p> <p>1.5. Adapt and use relevant ideas and approaches with consideration of <b><i>intellectual property requirements</i></b></p>
2. Select drawing techniques for refinement	<p>2.1. Consider the <b><i>opportunities</i></b> offered by different drawing techniques</p> <p>2.2. Determine <b><i>limitations and constraints</i></b> of particular techniques</p> <p>2.3. Select drawing techniques for <b><i>refinement</i></b></p>
3. Consolidate drawing technique to professional level	<p>3.1. Establish and follow <b><i>safe work practices</i></b> for selected techniques</p> <p>3.2. Develop increasing confidence and skill through practice and experimentation</p> <p>3.3. Proactively identify and resolve <b><i>technical problems</i></b> in drawing projects based on developing expertise</p> <p>3.4. Challenge and test ideas, and allow new and unpredictable ideas to emerge</p> <p>3.5. Evolve ideas and other professional skills through</p>

	<p>ongoing experimentation with technique</p> <p>3.6. Develop own ways of working with techniques to create individual style</p> <p>3.7. Create a <b><i>coherent body of drawing work</i></b> that shows command of selected drawing techniques</p>
4. Evaluate own drawing technique	<p>4.1. Evaluate development of own technique with others and seek feedback</p> <p>4.2. Seek and participate in conversations that challenge and explore different concepts and approaches</p> <p>4.3. Reflect on the particular ways that experimentation with different techniques has informed own artwork</p> <p>4.4. Identify <b><i>ways in which technique may be further developed</i></b> as part of a professional practice and build ideas into future work</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to engage with others about the technical and conceptual aspects of drawing with others
- critical thinking and analytical skills to:
  - evaluate and make judgements about relationships between drawing technique, effects and ideas
  - make critical evaluations of own drawing technique
  - make critical evaluations of research findings
- initiative and enterprise skills to identify and act on opportunities for own practice presented by research
- learning skills to develop and refine own skills to a professional practice standard
- literacy skills to analyse complex and varied information about drawing technique
- problem-solving skills to identify and resolve technical problems in drawing work
- self-management and planning skills to create a coherent body of drawing work
- technical skills to show command of chosen drawing techniques at a professional level
- technology skills to use the internet as a research tool.

### Required knowledge

- relationship between drawing technique, particular effects and ideas in the work of other artists and in the context of own practice
- extended range of information sources that support research in drawing practice
- cultural, sociological, philosophical, aesthetic, political and commercial influences on drawing technique, in historical and contemporary contexts
- professional development opportunities for artists seeking to develop a drawing practice
- elements and principles of design and how they may be used, adapted and challenged in the creation of work
- intellectual property issues and legislation associated with drawing as a professional practice
- sustainability issues for the professional operation of a drawing practice
- OHS requirements for the set-up and operation of a professional work space for drawing.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• evolve and refine drawing technique through a demonstrated process of experimentation</li> <li>• develop individual style in own work</li> <li>• produce a coherent body of professional artwork that includes the use of well-developed drawing technique</li> <li>• research drawing technique in the broader context of other artwork and artists</li> <li>• use safe and sustainable work practices.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• equipment, materials and tools used to produce drawing work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of drawing technique within a body of work produced by the candidate</li> <li>• evaluation of processes used by the candidate to evolve and refine drawing technique</li> <li>• evaluation of the work documentation</li> </ul>

	<ul style="list-style-type: none"> <li>• direct observation of drawing in progress, including exploration of, and experimentation with, techniques</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP501A Realise a body of creative work.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Drawing techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• abrasive technique</li> <li>• additive technique</li> <li>• application of pigment</li> <li>• collage or frottage</li> <li>• digital drawing techniques</li> <li>• erasure or subtractive techniques</li> <li>• hatching and cross-hatching</li> <li>• integration of text and drawing</li> <li>• linear marks:             <ul style="list-style-type: none"> <li>• of differing character</li> <li>• of differing intensity and character</li> <li>• to produce illusion of form in space</li> </ul> </li> <li>• linear perspective</li> <li>• resist techniques</li> </ul>
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	<ul style="list-style-type: none"> <li>• scaling techniques</li> <li>• simple linear perspective</li> <li>• tonal range to produce illusion of form in space</li> <li>• use of positive and negative space.</li> </ul>
<b>Technical effects</b> may include:	<ul style="list-style-type: none"> <li>• atmosphere</li> <li>• chiaroscuro</li> <li>• illusion</li> <li>• mood</li> <li>• movement</li> <li>• perspective</li> <li>• trompe l'oeil.</li> </ul>
<b>Intellectual property requirements</b> may relate to:	<ul style="list-style-type: none"> <li>• copyright</li> <li>• design licensing regulations</li> <li>• form of acknowledgement or credit</li> <li>• moral rights</li> <li>• protocols for the adaptation of work by others</li> <li>• trademarks.</li> </ul>
<b>Opportunities</b> may relate to:	<ul style="list-style-type: none"> <li>• communication of ideas</li> <li>• natural affinity with particular techniques</li> <li>• potential for combining techniques</li> <li>• potential for interactions between technique and media</li> <li>• themes in work.</li> </ul>
<b>Limitations and constraints</b> may relate to:	<ul style="list-style-type: none"> <li>• availability of materials</li> <li>• capacity of technique to deliver required effect</li> <li>• own interaction with technique</li> <li>• resources</li> <li>• time.</li> </ul>
<b>Refinement</b> relates to:	<ul style="list-style-type: none"> <li>• ability to use selected techniques with confidence</li> <li>• ongoing demonstration of development of technique</li> <li>• use of selected techniques in a body of professional work.</li> </ul>
<b>Safe work practices</b> may include:	<ul style="list-style-type: none"> <li>• completing material safety data sheets (MSDS)</li> <li>• correct disposal of waste materials</li> <li>• dust and fume extraction</li> <li>• ergonomic safety</li> <li>• managing risk</li> <li>• reporting accidents and incidents</li> <li>• use of tools and equipment</li> <li>• using clearly designated wet and dry areas</li> <li>• using personal protective equipment (PPE).</li> </ul>
<b>Technical problems</b>	<ul style="list-style-type: none"> <li>• implications of scale and size</li> <li>• limitations of digital technology</li> </ul>

may include:	<ul style="list-style-type: none"><li>• limitations of materials.</li></ul>
<i>Coherent body of drawing work</i> is:	<ul style="list-style-type: none"><li>• conceptually resolved</li><li>• documented in terms of its development</li><li>• subject to critical feedback by others</li><li>• technically resolved</li><li>• thematically connected.</li></ul>
<i>Ways in which technique may be further developed</i> may include:	<ul style="list-style-type: none"><li>• collaboration</li><li>• further study</li><li>• intensive workshops</li><li>• mentored guidance</li><li>• new projects.</li></ul>

## Unit Sector(s)

Visual communication – drawing



## CUVDRA502A Investigate drawing materials and processes

### Modification History

Version	Comments
CUVDRA502A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to research and explore selected drawing materials and processes and integrate their use into creative practice. This unit relates to drawing as an art form and therefore differs from units that focus on drawing as a visual representation tool.

### Application of the Unit

Artists who create drawing as art apply the skills and knowledge in this unit.

Material and process exploration at this level is a largely independent activity with mentoring and guidance as required. It would normally include investigation of a range of materials and processes to develop an individual professional style. In practice, this process is integrated with the skills described in the unit CUVPRP501A Realise a body of creative work.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Element	Performance Criteria
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*Elements describe the essential outcomes of a unit of competency.*

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Research drawing materials and processes	<p>1.1. Research the detailed <b><i>physical properties and capabilities</i></b> of different <b><i>drawing materials</i></b></p> <p>1.2. Investigate the <b><i>safety issues</i></b> associated with different materials and processes prior to use</p> <p>1.3. Collate and store safety and technical <b><i>data</i></b> to meet safety requirements and inform future practice</p> <p>1.4. Investigate the relationship between materials and <b><i>drawing processes</i></b></p> <p>1.5. Explore the relationships between ideas and materials or process</p> <p>1.6. Determine <b><i>cost and supply parameters</i></b></p>
2. Select drawing materials and processes for in-depth exploration	<p>2.1. Assess the <b><i>creative and professional opportunities</i></b> offered by different drawing materials and processes</p> <p>2.2. Determine <b><i>limitations and constraints</i></b> of particular materials and processes</p> <p>2.3. Select particular materials and processes that suit own practice</p>
3. Integrate drawing materials and processes into own work	<p>3.1. Explore <b><i>different ways of working with materials and processes</i></b> to achieve desired outcomes</p> <p>3.2. Challenge and stretch the capabilities and uses of different materials and processes through experimentation</p> <p>3.3. Develop <b><i>own ways of working</i></b> with materials and processes</p> <p>3.4. Engage in informed discussion with others about the characteristics and opportunities of particular drawing materials and processes</p> <p>3.5. Establish and follow <b><i>safe work practices</i></b></p>

4. Manage drawing resources in professional practice	4.1. Establish a <i>sustainable supply</i> of drawing resources 4.2. Develop ways of working with resources that minimise waste 4.3. Maintain the quality and life of drawing resources through <i>appropriate handling and storage</i>
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## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to engage in informed discussion around materials, processes and their relationship with ideas
- critical thinking and analytical skills to evaluate and make judgements about relationships between drawing materials, techniques and processes
- initiative and enterprise skills to:
  - develop individual ways of working with materials and processes
  - identify and act on opportunities for own practice presented by different materials and processes
- learning skills to develop and refine own skills to a professional practice standard
- literacy skills to analyse varied and technical information about drawing materials and processes
- problem-solving skills to identify and resolve technical problems in drawing work
- self-management and planning skills to:
  - develop own ways of working with drawing materials and processes
  - research and organise sustainable supply of materials and processes
- technology skills to use the internet as a research tool.

### Required knowledge

- ways in which a wide range of drawing materials and processes can be used, adapted, combined and challenged by the professional artist
- physical properties and capabilities of the selected materials and processes
- types of technical and other data that may need to be stored for safety and other reasons
- characteristics of different materials under different treatments and the potential of these characteristics to achieve different effects
- cost and supply parameters for drawing materials and tools in the context of professional practice
- storage requirements and options for different materials

- intellectual property issues and legislation associated with drawing as a professional practice
- sustainability issues for the professional operation of a drawing practice
- OHS requirements for the set-up and operation of a professional work space.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• apply knowledge of drawing materials and processes and how they may be adapted and extended at a professional level</li> <li>• evolve and refine ways of working with materials and processes through a demonstrated process of experimentation</li> <li>• integrate materials and processes into own work in a way that supports coherence of the creative work</li> <li>• demonstrate technical proficiency in the use of selected materials and processes</li> <li>• use safe and sustainable work practices.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• equipment, materials and tools used to produce drawings.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of the use of materials and processes in terms of the coherence of the body of work</li> <li>• evaluation of processes used by the candidate to develop new ways of working with drawing materials and processes</li> <li>• evaluation of the work documentation</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced</li> </ul>

	<p>practitioners.</p> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP501A Realise a body of creative work.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Physical properties and capabilities</i></b> may include:	<ul style="list-style-type: none"> <li>• dryness</li> <li>• flexibility</li> <li>• fluidity</li> <li>• hardness</li> <li>• opacity</li> <li>• permanency</li> <li>• softness</li> <li>• transparency.</li> </ul>
<b><i>Drawing materials</i></b> may include:	<ul style="list-style-type: none"> <li>• blended materials</li> <li>• erasers of different types</li> <li>• fluids</li> <li>• found objects</li> <li>• improvised media</li> <li>• inks</li> <li>• natural materials</li> <li>• paints</li> <li>• pastels and chalks</li> <li>• pigments</li> <li>• protective sprays</li> <li>• solvents</li> </ul>

	<ul style="list-style-type: none"> <li>• surface materials: <ul style="list-style-type: none"> <li>• board</li> <li>• fabric</li> <li>• glass</li> <li>• metal</li> <li>• paper</li> <li>• perspex</li> <li>• wood</li> </ul> </li> <li>• tapes</li> <li>• traditional drawing materials.</li> </ul>
<i>Safety issues</i> may relate to:	<ul style="list-style-type: none"> <li>• dust and airborne particles</li> <li>• equipment used for drawing</li> <li>• fire</li> <li>• fumes</li> <li>• manual handling requirements</li> <li>• noise</li> <li>• sharp objects</li> <li>• use and labelling of chemicals</li> <li>• use of equipment with moving parts</li> <li>• work posture.</li> </ul>
<i>Data</i> may include:	<ul style="list-style-type: none"> <li>• material safety data sheets (MSDS)</li> <li>• quantity calculations</li> <li>• results of experimentation.</li> </ul>
<i>Drawing processes</i> may include:	<ul style="list-style-type: none"> <li>• digital drawing techniques</li> <li>• integration of text and drawing</li> <li>• linear marks: <ul style="list-style-type: none"> <li>• of differing intensity and character</li> <li>• to produce illusion of form in space</li> </ul> </li> <li>• linear perspective</li> <li>• scaling techniques</li> <li>• tonal range to produce illusion of form in space</li> <li>• use of positive and negative space.</li> </ul>
<i>Cost and supply parameters</i> may relate to:	<ul style="list-style-type: none"> <li>• budgetary restrictions</li> <li>• capacity to share costs with others</li> <li>• continuity of supply</li> <li>• delivery issues</li> <li>• location of suppliers</li> <li>• potential for use of found objects</li> <li>• terms of payment</li> <li>• use of freely available natural materials</li> <li>• use of recycled materials.</li> </ul>

<b><i>Creative and professional opportunities</i></b> may relate to:	<ul style="list-style-type: none"> <li>• creative potential: <ul style="list-style-type: none"> <li>• communication of ideas</li> <li>• personal affinity with particular materials and processes</li> <li>• potential for combining materials and processes</li> <li>• potential for interactions of different materials and processes</li> <li>• themes in work</li> </ul> </li> <li>• professional potential: <ul style="list-style-type: none"> <li>• collaboration</li> <li>• emerging market trends</li> <li>• professional development</li> <li>• saleability.</li> </ul> </li> </ul>
<b><i>Limitations and constraints</i></b> may include:	<ul style="list-style-type: none"> <li>• availability of supplies</li> <li>• financial expenditure</li> <li>• safety aspects of process</li> <li>• storage facilities</li> <li>• studio space</li> <li>• timeframe</li> <li>• transportation.</li> </ul>
<b><i>Different ways of working with materials and processes</i></b> may involve:	<ul style="list-style-type: none"> <li>• combining materials and processes in new ways</li> <li>• making samples, prototypes and maquettes</li> <li>• varying established approaches to achieve new effects</li> <li>• working collaboratively with a particular material or process.</li> </ul>
<b><i>Own ways of working</i></b> may include:	<ul style="list-style-type: none"> <li>• approaches that reflect and support individual voice</li> <li>• particular nuances and subtleties unique to the individual artist.</li> </ul>
<b><i>Safe work practices</i></b> may include:	<ul style="list-style-type: none"> <li>• completing MSDS</li> <li>• correct disposal of waste materials</li> <li>• dust and fume extraction</li> <li>• ergonomic safety</li> <li>• managing risk</li> <li>• reporting accidents and incidents</li> <li>• use of tools and equipment</li> <li>• using clearly designated wet and dry areas</li> <li>• using personal protective equipment (PPE).</li> </ul>
<b><i>Sustainable supply</i></b> is:	<ul style="list-style-type: none"> <li>• available when needed</li> <li>• environmentally friendly</li> <li>• of appropriate quality</li> <li>• safe</li> </ul>

	<ul style="list-style-type: none"><li>• within budgetary requirements.</li></ul>
<i>Appropriate handling and storage</i> may include:	<ul style="list-style-type: none"><li>• handling damage</li><li>• insect proofing</li><li>• light sensitivity</li><li>• longevity of materials</li><li>• mould prevention.</li></ul>

## Unit Sector(s)

Visual communication – drawing



## CUVGRD301A Prepare files for publication

### Modification History

Version	Comments
CUVGRD301A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to prepare electronic files for pre-press processing. It applies to files that still require some processing before printing or electronic distribution.

### Application of the Unit

People working in any industry apply the skills and knowledge outlined in this unit. They may work as individuals providing administrative support in an enterprise, or may be technical or knowledge experts responsible for preparing their own files for publication as either hard or soft copy documents.

At this level, work would be undertaken independently but within established parameters. Supervision or guidance is available as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

#### Element

#### Performance Criteria

*Elements describe the essential outcomes of a unit of competency.*

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Clarify formatting requirements	<p>1.1. Review documentation that provides information on printing <b>requirements</b> and the <b>end use</b> for text and image files</p> <p>1.2. Plan work to comply with <b>pre-press</b> requirements in consultation with <b>relevant people</b></p> <p>1.3. Take account of the requirements for different <b>publication processes</b> when planning work and selecting <b>software</b></p>
2. Prepare text for pre-press processing	<p>2.1. Save text in appropriate <b>format</b></p> <p>2.2. Review text to remove extraneous or unnecessary formatting</p> <p>2.3. Apply templates and styles as required</p>
3. Prepare graphics for pre-press processing	<p>3.1. Ensure scans are completed at appropriate <b>resolution</b></p> <p>3.2. Use appropriate scanning curve</p> <p>3.3. Save colour in required format</p> <p>3.4. Undertake basic <b>manipulation</b> of digital images as required</p> <p>3.5. Ensure that combined images can be edited and adjusted</p> <p>3.6. Check that all templates and styles have been applied correctly</p> <p>3.7. Save final graphic images in appropriate format</p>
4. Finalise work	<p>4.1. Evaluate final files for visual impact, effectiveness and fitness for purpose</p> <p>4.2. Use feedback from others to improve own skills in preparing files for publication</p> <p>4.3. Submit files to relevant personnel as required</p> <p>4.4. Make back-up copies of files in line with organisational</p>

	procedures
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## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to clarify written and verbal instructions
- initiative and enterprise skills to make adjustments to the layout and look of text and image files to produce the optimum visual outcome
- learning skills to improve own skills from feedback
- literacy skills to interpret information and material related to preparing files for publication
- numeracy skills to calculate document layout requirements
- planning and organising skills to plan work tasks in a logical sequence
- self-management skills to prioritise work tasks and complete work within agreed timeframes
- problem-solving skills to use processes flexibly and interchangeably
- technology skills to:
  - proficiently use common page layout software applications
  - proficiently use a scanner to reproduce photo images to specification
  - use digital imaging software for basic manipulation of digital images
  - manage files using standard naming conventions.

### Required knowledge

- design issues related to different hard copy and electronic publishing processes
- file formats for various outputs
- basic colour theory in relation to preparing files for pre-press
- basic typographic theory in relation to preparing files for pre-press
- elements and principles of design
- intellectual property issues and legislation associated with pre-press preparation
- sustainability considerations for equipment, tools and materials associated with pre-press processing work
- OHS procedures in relation to preparation for pre-press processing work, including ergonomics.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• prepare text and graphic files that meet required output specifications for at least two hard copy and two soft copy jobs</li> <li>• apply knowledge of current pre-press techniques and technologies.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• industry-standard page layout and digital imaging software.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of the candidate undertaking pre-press processing work</li> <li>• evaluation of files prepared by the candidate</li> <li>• discussion and questioning about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• BSBITU309A Produce desktop published documents</li> <li>• CUFDIG303A Produce and prepare photo images</li> <li>• CUVGRD302A Use typography techniques.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Requirements</i></b> may relate to:	<ul style="list-style-type: none"> <li>• file formats:             <ul style="list-style-type: none"> <li>• images</li> <li>• text</li> </ul> </li> <li>• file size</li> <li>• image resolution.</li> </ul>
<b><i>End use</i></b> of text and images may be for:	<ul style="list-style-type: none"> <li>• annual reports</li> <li>• book covers</li> <li>• corporate presentations</li> <li>• corporate stationery</li> <li>• electronic distribution, including as attachments:             <ul style="list-style-type: none"> <li>• to electronic communications</li> <li>• for download from websites</li> </ul> </li> <li>• invitations</li> <li>• posters.</li> </ul>
<b><i>Pre-press</i></b> includes:	<ul style="list-style-type: none"> <li>• pre-press section of a printing company</li> <li>• pre-press trade houses or bureaus.</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• client</li> <li>• designer</li> <li>• graphic artist</li> <li>• manager</li> <li>• online production personnel</li> <li>• other specialist creative and administrative staff</li> <li>• supervisor.</li> </ul>
<b><i>Publication processes</i></b> may include:	<ul style="list-style-type: none"> <li>• any hard copy printing process</li> <li>• electronic platforms:             <ul style="list-style-type: none"> <li>• CD</li> <li>• DVD</li> <li>• games console</li> <li>• internet</li> <li>• kiosk</li> <li>• mobile phone</li> <li>• other video playback devices</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• personal digital assistant (PDA)</li> <li>• video players (iPods).</li> </ul>
<b>Software</b> may include:	<ul style="list-style-type: none"> <li>• computer-aided design and drafting (CADD)</li> <li>• digital imaging: <ul style="list-style-type: none"> <li>• Adobe Photoshop</li> <li>• Corel Paint Shop Pro</li> </ul> </li> <li>• layout and page description applications</li> <li>• word processing applications.</li> </ul>
<b>Format</b> may relate to:	<ul style="list-style-type: none"> <li>• colour: <ul style="list-style-type: none"> <li>• CMYK</li> <li>• RGB</li> </ul> </li> <li>• image files: <ul style="list-style-type: none"> <li>• GIF</li> <li>• JPEG</li> <li>• PICT</li> <li>• PNG</li> <li>• PSD</li> <li>• TIFF</li> </ul> </li> <li>• text files: <ul style="list-style-type: none"> <li>• PDF</li> <li>• file outputs from word processing applications.</li> </ul> </li> </ul>
<b>Resolution</b> may be:	<ul style="list-style-type: none"> <li>• high</li> <li>• low, e.g. for position only (FPO)</li> <li>• medium.</li> </ul>
<b>Manipulation</b> may relate to:	<ul style="list-style-type: none"> <li>• appending text/type for files and captions</li> <li>• brushing</li> <li>• creating artistic effects</li> <li>• cropping</li> <li>• eliminating red eye</li> <li>• emulating photographic effects</li> <li>• image enhancement, including: <ul style="list-style-type: none"> <li>• tones</li> <li>• contrast</li> <li>• colour</li> <li>• cast or tint</li> <li>• saturation</li> </ul> </li> <li>• masking layers</li> <li>• retouching</li> <li>• sharpening.</li> </ul>

## **Unit Sector(s)**

Visual communication – graphic design

## CUVJWL401A Experiment with techniques to produce jewellery

### Modification History

Version	Comments
CUVJWL401A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to proactively experiment and innovate with various jewellery-making techniques and ideas to develop an individual style or voice.

### Application of the Unit

People with a command of jewellery-making techniques apply the skills and knowledge in this unit. They often produce work at a pre-professional level for sale in a range of outlets, such as markets and fairs.

At this level, work is undertaken independently with supervision and guidance as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

#### Element

#### Performance Criteria

*Elements describe the essential outcomes*

*Performance criteria describe the performance needed to demonstrate*



of a unit of competency.

achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1. Develop proficiency with a range of jewellery-making techniques and media	<p>1.1. Evaluate the potential for new approaches to jewellery making based on capabilities of <b><i>techniques</i></b> already used</p> <p>1.2. Adapt or introduce new <b><i>tools, equipment</i></b> and <b><i>materials</i></b> to achieve different effects</p> <p>1.3. <b><i>Extend</i></b> the capabilities of jewellery-making techniques through experimentation</p> <p>1.4. Take account of the <b><i>safety and sustainability considerations</i></b> for different techniques and media</p>
2. Develop ideas for jewellery	<p>2.1. Articulate creative and other goals for jewellery work</p> <p>2.2. <b><i>Research</i></b>, adapt and use relevant <b><i>ideas</i></b> and approaches from other practitioners with consideration of <b><i>intellectual property requirements</i></b></p> <p>2.3. Apply knowledge of different jewellery-making techniques to inform ideas</p> <p>2.4. Allow techniques and ideas to work together to inform each other</p> <p>2.5. Consider the <b><i>professional potential</i></b> and other <b><i>criteria</i></b> for work when developing ideas</p> <p>2.6. <b><i>Refine</i></b> and confirm ideas based on experimentation, research and collaboration with others</p>
3. Organise jewellery-making resources	<p>3.1. Assess specific resource requirements for the chosen work</p> <p>3.2. Research and access potential <b><i>sources of supply</i></b> for jewellery-making resources</p> <p>3.3. Evaluate <b><i>cost and other constraints</i></b> that impact on the development of work</p> <p>3.4. Evaluate and respond to <b><i>presentation considerations</i></b> for finished jewellery</p> <p>3.5. Set up or coordinate resource requirements according to</p>

	safety and other workplace requirements
4. Create finished jewellery	<p>4.1. Create jewellery, using techniques and media selected from research and experimentation</p> <p>4.2. Review and refine ideas and approaches based on ongoing experience with the production of work</p> <p>4.3. Use safe and sustainable work practices throughout the production of jewellery</p> <p>4.4. Document and record the development of the work and the research and ideas that inform it</p>
5. Evaluate own jewellery work	<p>5.1. Reflect on own work in terms of conceptual development and technical execution</p> <p>5.2. Identify areas for future improvement especially in terms of own skill development</p> <p>5.3. Discuss completed work with others and respond positively to feedback</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to:
  - discuss ideas and techniques in own work
  - create a record of the jewellery work
- initiative and enterprise skills to:
  - experiment with techniques to enhance final jewellery
  - apply critical thinking and analytical skills when developing ideas for jewellery
- learning skills to:
  - refine and improve a range of techniques
  - evaluate quality of own work and identify ways to enhance own practice
- literacy skills to undertake research about the work of other jewellery makers and other arts practitioners
- numeracy skills to:
  - evaluate resource costs
  - calculate material requirements
- planning and organising skills to plan work tasks and resources

- problem-solving skills to identify and resolve technical and conceptual issues in jewellery-making work
- technology skills to use the internet as a research tool.

### Required knowledge

- role of experimentation in developing and refining ideas for jewellery making and how this relates to the development of an individual style or voice
- ways to adapt, extend and combine the capabilities of a wide range of jewellery-making materials and techniques
- physical properties and capabilities of an extended range of materials and tools used in jewellery making
- characteristics of different materials under different treatments and the potential of these characteristics to achieve different effects
- formal elements and principles of design and how they may be used, adapted and challenged in jewellery-making work
- research methodologies used by artists
- historical and theoretical contexts for jewellery making and how they may be used to inform individual practice
- sources of raw, part-processed and processed jewellery-making materials
- sources of other resources needed in a professional jewellery-making practice
- intellectual property issues and legislation to be considered by independent arts practitioners
- sustainability considerations for the professional operation of a jewellery-making practice
- OHS requirements for the set-up and operation of jewellery-making work space.

### Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• develop ideas and techniques through a process of research and experimentation</li> <li>• produce multiple finished jewellery items or a single major work that demonstrate a command of techniques</li> <li>• apply knowledge of jewellery-making techniques, equipment and materials and the ways they may be adapted and combined</li> <li>• use safe and sustainable work practices.</li> </ul>

<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• equipment, materials and tools used to produce jewellery.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of technical execution of work pieces produced by the candidate</li> <li>• direct observation of jewellery making in progress, including exploration of, and experimentation with, techniques</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP401A Realise a creative project.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Techniques</b> may include:	<ul style="list-style-type: none"> <li>• anodising</li> <li>• binding</li> <li>• casting</li> <li>• champlevé</li> <li>• cloisonné</li> </ul>
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	<ul style="list-style-type: none"> <li>• embossing</li> <li>• enamelling</li> <li>• engraving</li> <li>• etching</li> <li>• fabrication</li> <li>• forging</li> <li>• fusion</li> <li>• granulation</li> <li>• grinding</li> <li>• lathe work</li> <li>• mould making</li> <li>• patination</li> <li>• plique-a-jour</li> <li>• polishing and finishing</li> <li>• pressing and forming</li> <li>• reticulation</li> <li>• soldering</li> <li>• stone setting</li> <li>• a combination of techniques.</li> </ul>
<b><i>Tools and equipment</i></b> may include:	<ul style="list-style-type: none"> <li>• guillotine</li> <li>• hand drill and drill bits</li> <li>• hand tools: <ul style="list-style-type: none"> <li>• brushes</li> <li>• burr</li> <li>• centre punch</li> <li>• clamps</li> <li>• files</li> <li>• hammers</li> <li>• knives</li> <li>• mallets</li> <li>• piercing saw and range of blades</li> <li>• pliers</li> <li>• scissors</li> <li>• scribe</li> <li>• snips</li> <li>• tongs</li> <li>• tweezers</li> </ul> </li> <li>• jewellery bench</li> <li>• measuring devices</li> <li>• measuring tools</li> <li>• modelling tools and sets</li> </ul>

	<ul style="list-style-type: none"> <li>• needles</li> <li>• power tools, such as sander</li> <li>• protective clothing</li> <li>• specialised items for: <ul style="list-style-type: none"> <li>• embossing</li> <li>• engraving</li> <li>• gluing</li> <li>• piercing</li> <li>• silversmithing</li> <li>• soldering</li> <li>• welding.</li> </ul> </li> </ul>
<b>Materials</b> may include:	<ul style="list-style-type: none"> <li>• fabricated materials: <ul style="list-style-type: none"> <li>• das</li> <li>• fabrics</li> <li>• fibres</li> <li>• fimo</li> <li>• metal objects</li> <li>• papier-mâché</li> <li>• plastic</li> <li>• twine</li> </ul> </li> <li>• found objects</li> <li>• gem stones</li> <li>• metals: <ul style="list-style-type: none"> <li>• brass</li> <li>• copper</li> <li>• gilding metal</li> <li>• pewter</li> <li>• silver</li> </ul> </li> <li>• natural objects: <ul style="list-style-type: none"> <li>• bones</li> <li>• clay</li> <li>• feathers</li> <li>• palm fronds</li> <li>• seeds</li> <li>• shells</li> <li>• twigs</li> <li>• vines</li> <li>• wood.</li> </ul> </li> </ul>
<b>Extending</b> capabilities through	<ul style="list-style-type: none"> <li>• exploring the full potential of the art form</li> <li>• innovation.</li> </ul>

experimentation involve:	
<b><i>Safety and sustainability considerations</i></b> may include:	<ul style="list-style-type: none"> <li>• federal, state and territory legislation, regulations and standards</li> <li>• personal protection</li> <li>• recycling</li> <li>• safe disposal of waste.</li> </ul>
<b><i>Research</i></b> may involve:	<ul style="list-style-type: none"> <li>• approaching individuals with relevant expertise</li> <li>• attending lectures and talks</li> <li>• conducting material and technical experiments and tests</li> <li>• seeking out information in books, journals, newspapers</li> <li>• searching the internet</li> <li>• visiting exhibitions and museums.</li> </ul>
<b><i>Ideas</i></b> may be influenced by:	<ul style="list-style-type: none"> <li>• artistic aspirations</li> <li>• current capability with techniques</li> <li>• historical and theoretical contexts</li> <li>• subject matter or theme for the work, such as: <ul style="list-style-type: none"> <li>• built environment</li> <li>• land and place</li> <li>• natural world</li> <li>• political, cultural and social issues</li> <li>• the body</li> </ul> </li> <li>• spiritual concerns.</li> </ul>
<b><i>Intellectual property requirements</i></b> may relate to:	<ul style="list-style-type: none"> <li>• extent to which the work may be used</li> <li>• form of acknowledgement or credit</li> <li>• procedures for seeking permission to use the work of others, including systems for the administration of copyright</li> <li>• protocols for the adaptation of work by others.</li> </ul>
<b><i>Professional potential</i></b> may relate to:	<ul style="list-style-type: none"> <li>• cost of production</li> <li>• existence of an established market</li> <li>• how to promote or sell the work</li> <li>• market trends</li> <li>• professional development.</li> </ul>
<b><i>Criteria</i></b> may relate to:	<ul style="list-style-type: none"> <li>• client and user expectations</li> <li>• duration</li> <li>• environment in which textile work will be viewed</li> <li>• materials</li> <li>• quality of final product</li> <li>• techniques</li> <li>• timelines</li> </ul>

	<ul style="list-style-type: none"><li>• tools.</li></ul>
Process followed to <i>refine</i> ideas may include:	<ul style="list-style-type: none"><li>• adjustment to take account of elements and principles of design</li><li>• adjustment to subject matter or theme</li><li>• adjustment to use extended capabilities of the technique.</li></ul>
<i>Sources of supply</i> may include:	<ul style="list-style-type: none"><li>• commercial outlets</li><li>• found objects and materials</li><li>• manufacturing or factory waste</li><li>• nature.</li></ul>
<i>Cost and other constraints</i> may relate to:	<ul style="list-style-type: none"><li>• availability of materials and tools</li><li>• budgeting</li><li>• sponsorship</li><li>• timeframe.</li></ul>
<i>Presentation considerations</i> may include:	<ul style="list-style-type: none"><li>• availability of space</li><li>• cost</li><li>• practical considerations</li><li>• presentation context</li><li>• timeframe.</li></ul>

## Unit Sector(s)

Visual communication – jewellery



## CUVPHI302A Capture photographic images

### Modification History

Version	Comments
CUVPHI302A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to apply a range of techniques to capture images using a standard digital stills camera.

### Application of the Unit

This unit describes many of the foundation skills needed by those planning a career in photo imaging, but also applies in contexts where photography may not be the primary job role or main focus of work activity. For example, in the creative sectors a visual artist uses these skills to document the progress of work. In the events industry, an event coordinator might need to take photographs of potential venues or site layouts. Image styles may be technical, photojournalistic or illustrative. Further skills needed by professional photographers are covered in the unit CUVPHI401A Capture images in response to a brief.

At this level, work would be undertaken independently but within established parameters. Supervision or guidance is available as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Prepare to capture digital images	<p>1.1. Discuss photographic project with <b>relevant people</b> and select appropriate camera and <b>accessories</b></p> <p>1.2. Assess <b>digital camera features</b> to ensure that outcomes meet project requirements</p> <p>1.3. Plan shots for the project taking into account digital camera features, <b>lighting, photographic design elements and photographic techniques</b></p>
2. Preview and experiment with image capture	<p>2.1. Operate digital camera according to manufacturer specifications</p> <p>2.2. Set digital camera preferences and use photographic techniques to achieve desired results</p> <p>2.3. Adjust planned shots as required and experiment with different ways of achieving desired results</p>
3. Review images	<p>3.1. Download digital images or scan developed film images using appropriate <b>digital imaging software</b> where appropriate</p> <p>3.2. Rotate, cull, <b>sort</b> and rename images to meet requirements</p> <p>3.3. Apply <b>metadata</b> and key words to images as required</p> <p>3.4. Back up and archive as required</p> <p>3.5. Seek feedback from others on quality of original captures and note areas for future improvement</p>
4. Enhance images	<p>4.1. <b>Enhance</b> images using digital imaging software</p> <p>4.2. Evaluate outcome against project requirements and confirm with relevant people as required</p> <p>4.3. Seek feedback from others on quality of enhanced images</p>

	and note areas for future improvement
5. Finalise image capture process	<p>5.1. Catalogue as required, ensuring extraction and embedding of all necessary metadata as required</p> <p>5.2. Complete workplace <b>documentation</b> as required</p> <p>5.3. Clean and store equipment and accessories according to workplace procedures</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication and literacy skills to:
  - interpret and clarify written and verbal instructions
  - follow instructions in equipment operation manuals
  - interpret technical charts or diagrams associated with standard cameras
- critical thinking skills to evaluate a range of information in order to assess and respond to the requirements of a photo imaging project
- problem-solving skills to:
  - resolve minor equipment set-up problems
  - identify and correct image issues when enhancing
- self-management skills to:
  - work within requirements of a project
  - seek expert assistance when required
- technical skills to proficiently use:
  - a digital camera to create well-composed photo images
  - software and other equipment to enhance photo images.

### Required knowledge

- basic photographic techniques
- features of standard digital cameras
- cleaning and maintenance techniques for cameras and accessories
- key photo imaging industry terminology
- pixel count (megapixels) and how this relates to resolution and output size of the final image
- elements and principles of design for photo images
- manuals, safety and other documentation relevant to image capture and storage requirements and locations

- OHS procedures in relation to photo imaging work, cameras and computers.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• capture photo images that meet the quality and look requirements for a range of projects</li> <li>• use a wide range of features of a standard digital stills camera.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• materials, resources and equipment needed to capture digital photographic images.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• practical demonstration of skills using a camera to capture images for specific purposes</li> <li>• evaluation of images captured by the candidate</li> <li>• oral or written questioning to assess knowledge of camera techniques and features</li> <li>• discussion and/or written report of the nominated techniques applied to selected subject matter</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• clients</li> <li>• colleagues</li> <li>• managers</li> <li>• mentors</li> <li>• other specialised creative staff</li> <li>• people being photographed</li> <li>• supervisors</li> <li>• teachers.</li> </ul>
<b><i>Accessories</i></b> may include:	<ul style="list-style-type: none"> <li>• batteries</li> <li>• computer and monitor, including laptop computer</li> <li>• computer cables and hub</li> <li>• extension leads</li> <li>• filters</li> <li>• lens hoods</li> <li>• light reflectors</li> <li>• light absorbers</li> <li>• monopod</li> <li>• memory storage devices: <ul style="list-style-type: none"> <li>• flash drive</li> <li>• external hard drive</li> <li>• memory card</li> </ul> </li> <li>• range of lenses</li> <li>• tripod.</li> </ul>
<b><i>Digital camera features</i></b> may include:	<ul style="list-style-type: none"> <li>• aperture: minimum and maximum values</li> <li>• battery: type, size, voltage and output power</li> <li>• colour, target and working space</li> <li>• compatibility of hardware with digital imaging software</li> <li>• exposure compensation</li> <li>• file format and compression/quality if relevant</li> <li>• flash, such as:</li> </ul>

	<ul style="list-style-type: none"><li>• fill flash</li><li>• flash compensation</li><li>• on-off</li><li>• red-eye reduction</li><li>• second or rear curtain sync</li><li>• slow-sync</li><li>• focussing options:<ul style="list-style-type: none"><li>• auto</li><li>• facial recognition</li><li>• focus points</li><li>• manual</li></ul></li><li>• ISO: auto, manual, film speed and push/pull processing</li><li>• lens focal length:<ul style="list-style-type: none"><li>• close-up/macro</li><li>• telephoto</li><li>• wide angle</li></ul></li><li>• memory storage device: type, capacity and read/write speed</li><li>• menu functions</li><li>• metering options:<ul style="list-style-type: none"><li>• centre weighted</li><li>• matrix</li><li>• spot</li></ul></li><li>• operating modes:<ul style="list-style-type: none"><li>• aperture priority</li><li>• automatic (green square)</li><li>• manual</li><li>• program</li><li>• shutter priority</li></ul></li><li>• resolution: megapixels and compression/quality if relevant</li><li>• scene modes:<ul style="list-style-type: none"><li>• backlight</li><li>• beach</li><li>• fireworks</li><li>• macro</li><li>• night</li><li>• snow</li><li>• sunset</li></ul></li><li>• shutter speed: minimum and maximum values</li><li>• subject modes:</li></ul>
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	<ul style="list-style-type: none"> <li>• portrait</li> <li>• landscape</li> <li>• sports</li> <li>• macro</li> <li>• viewfinder diopter adjustment values</li> <li>• white balance: <ul style="list-style-type: none"> <li>• auto (AWB)</li> <li>• Kelvin value</li> <li>• sunlight</li> <li>• shade</li> <li>• tungsten</li> </ul> </li> <li>• zoom: <ul style="list-style-type: none"> <li>• range</li> <li>• maximum aperture at extremities of focal length.</li> </ul> </li> </ul>
<b>Lighting</b> may be:	<ul style="list-style-type: none"> <li>• ambient</li> <li>• axis lighting</li> <li>• backlit</li> <li>• daylight</li> <li>• diffused</li> <li>• direct</li> <li>• directional-diffused</li> <li>• front lit</li> <li>• moonlight</li> <li>• natural light</li> <li>• on-camera flash</li> <li>• open shade</li> <li>• raking</li> <li>• reflected or bounced</li> <li>• rim light</li> <li>• side lighting</li> <li>• silhouetting</li> <li>• top or overhead lighting</li> <li>• under lighting</li> <li>• window light.</li> </ul>
<b>Photographic design elements</b> may relate to:	<ul style="list-style-type: none"> <li>• balance</li> <li>• colour relationships: <ul style="list-style-type: none"> <li>• accent on neutral</li> <li>• similar</li> <li>• complementary</li> <li>• monochromatic</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• tetrad</li> <li>• triad</li> <li>• composition: <ul style="list-style-type: none"> <li>• rule of thirds</li> <li>• golden mean</li> <li>• fallow edges (margins)</li> </ul> </li> <li>• contrast: increased or decreased</li> <li>• emphasis and de-emphasis, e.g. depth of field</li> <li>• eye tracking</li> <li>• framing: <ul style="list-style-type: none"> <li>• angle of view</li> <li>• field of view</li> <li>• point of view</li> </ul> </li> <li>• leading lines</li> <li>• line, curve, shape and form</li> <li>• positive and negative space</li> <li>• perspective</li> <li>• proportion</li> <li>• repetition</li> <li>• scale</li> <li>• subject separation: <ul style="list-style-type: none"> <li>• by colour</li> <li>• by focus</li> <li>• by tone</li> </ul> </li> <li>• symmetry and asymmetry</li> <li>• unity.</li> </ul>
<b><i>Photographic techniques</i></b> may be:	<ul style="list-style-type: none"> <li>• activating auto focus</li> <li>• setting depth of field: <ul style="list-style-type: none"> <li>• minimum and maximum hyperfocal points</li> <li>• relationship formula between focal length, distance from subject and aperture</li> </ul> </li> <li>• metering for exposure: <ul style="list-style-type: none"> <li>• contrast evaluation</li> <li>• grey card</li> <li>• incident</li> <li>• reflected</li> <li>• spot</li> </ul> </li> <li>• using focus lock and prefocus</li> <li>• controlling perspective with focal length: <ul style="list-style-type: none"> <li>• flattened</li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>• normal</li> <li>• steepened</li> <li>• working with moving subjects and motion: <ul style="list-style-type: none"> <li>• freezing movement with high shutter speed</li> <li>• freezing movement with flash</li> <li>• implying movement with second or rear curtain flash sync</li> <li>• panning a moving subject</li> <li>• implying movement with slow shutter speeds</li> <li>• capturing a time exposure sequence.</li> </ul> </li> </ul>
<b>Digital imaging software</b> may include:	<ul style="list-style-type: none"> <li>• wide range of programs, such as: <ul style="list-style-type: none"> <li>• Adobe Photoshop</li> <li>• Adobe Photoshop Elements</li> <li>• Adobe Photoshop Lightroom</li> <li>• Apple Aperture</li> <li>• Corel Paint Shop Pro</li> <li>• Corel PhotoPaint</li> <li>• GNU Image Manipulation Program (GIMP and GIMPshop).</li> </ul> </li> </ul>
<b>Sort</b> may include:	<ul style="list-style-type: none"> <li>• auto sort by metadata</li> <li>• drag into an order</li> <li>• flag</li> <li>• group like images together</li> <li>• label</li> <li>• rate</li> <li>• stack.</li> </ul>
<b>Metadata</b> may include:	<ul style="list-style-type: none"> <li>• copyright notice</li> <li>• copyright status</li> <li>• creator</li> <li>• date of capture/date created</li> <li>• description</li> <li>• international standards: <ul style="list-style-type: none"> <li>• EXIF</li> <li>• IPTC</li> <li>• PLUS</li> </ul> </li> <li>• headline or caption</li> <li>• job or identifier number</li> <li>• key words or tags</li> <li>• geotagging and GPS coordinates</li> <li>• rights usage and terms</li> </ul>

	<ul style="list-style-type: none"> <li>• subject</li> <li>• title</li> <li>• version.</li> </ul>
<b><i>Enhance</i></b> may include:	<ul style="list-style-type: none"> <li>• straightening: horizon or a known horizontal or vertical line</li> <li>• correcting perspective, such as converging verticals</li> <li>• cropping to discard surplus data</li> <li>• setting most common resolution, without resampling</li> <li>• specifying tonal range</li> <li>• allocating contrast</li> <li>• compensating for colour cast or tint</li> <li>• boosting vibrance, saturation and chroma</li> <li>• basic spotting: <ul style="list-style-type: none"> <li>• dust marks</li> <li>• remove red eye.</li> </ul> </li> </ul>
<b><i>Documentation</i></b> may be:	<ul style="list-style-type: none"> <li>• digital: <ul style="list-style-type: none"> <li>• catalogue</li> <li>• diagrams and plans</li> <li>• database</li> <li>• spreadsheets</li> </ul> </li> <li>• hard copy: <ul style="list-style-type: none"> <li>• visual diary</li> <li>• data sheets with notes</li> <li>• diagrams and plans</li> <li>• sketches.</li> </ul> </li> </ul>

## Unit Sector(s)

Visual communication – photo imaging

## CUVPHI403A Apply photo imaging lighting techniques

### Modification History

Version	Comments
CUVPHI403A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to select and apply lighting to a range of subjects in different work spaces.

Testing and tagging of electrical equipment must be carried out by a person with the relevant certificate of competency according to the performance specifications of Australian Standard 3760: 2000 In-service safety inspection and testing of electrical equipment and Australian Standard 3002: 1985 Electrical installations – shows and carnivals.

### Application of the Unit

Photographers apply the skills and knowledge described in this unit. On large photo shoots, this role could be assigned to a photographer's assistant. Photo shoots could be for the fashion industry, marketing and promotional activities, live entertainment events, as well as for film and television productions. Artists who use photography as a medium also apply these skills and knowledge.

At this level, work may be independent or supervised depending on the work context.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Set up lighting for photo shoot	1.1. Confirm lighting characteristics required for <b><i>subjects</i></b> in consultation with <b><i>relevant personnel</i></b> as required 1.2. Select <b><i>lighting equipment and accessories</i></b> that best fit the purpose of images 1.3. Determine <b><i>work environment needs</i></b> 1.4. Select appropriate <b><i>camera system and accessories</i></b> 1.5. Correctly assemble camera and lighting systems according to work requirements 1.6. Undertake work with due regard to <b><i>safety considerations</i></b> 1.7. Use equipment and <b><i>materials</i></b> in a manner that minimises waste
2. Light subjects	2.1. Position models and props as required 2.2. Test lighting <b><i>techniques</i></b> to determine their fitness for purpose 2.3. <b><i>Adjust</i></b> , modify and calibrate camera settings to meet lighting requirements 2.4. Work collaboratively with others when required to meet timelines associated with photo shoots
3. Complete and review shoot	3.1. Capture images using appropriate camera features 3.2. Review images against work requirements and adjust lighting as required 3.3. Document work process as required
4. Complete post-shoot	4.1. Safely clean and restore work environment to its original

activities	<p>state</p> <p>4.2. Clean and maintain equipment according to manufacturer instructions</p> <p>4.3. Report damage to equipment according to organisational procedures</p> <p>4.4. Safely transport and store equipment and materials and ensure readiness for future use</p>
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## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- literacy skills to interpret written instructions, safety labels and procedures
- numeracy skills to interpret technical charts and diagrams about lighting
- planning and organising skills to assemble and test lighting equipment in a logical sequence
- self-management skills to comply with OHS requirements and work to project parameters
- technical skills to:
  - assemble and disassemble lighting equipment for photo shoots
  - use different types of light-measuring devices.

### Required knowledge

- electromagnetic spectrum as it impacts on photo imaging practice
- colour temperature and colour synthesis in photo imaging practice
- ways in which light-sensitive materials, including films and digital sensors, respond to light
- effect of light on exposure of light-sensitive media
- physical properties and capabilities of camera systems and lighting equipment used in the exposure of photographic film and digital sensors
- elements and principles of design and their application to photographic lighting
- theoretical and historical contexts of lighting for photo imaging and a range of other art forms
- work, ideas and techniques of other photographers, especially with regard to lighting
- issues and challenges that arise in the context of lighting photo shoots
- sustainability considerations for photo imaging practice
- OHS issues and procedures associated with lighting.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>select appropriate camera and lighting equipment and accessories for range of different subjects in different physical environments</li> <li>apply appropriate lighting techniques to a range of different subjects in different physical environments.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>materials, resources and equipment needed to select, set up, adjust and apply camera and lighting systems.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>direct observation of the candidate setting up lighting equipment for a photo shoot and applying lighting techniques</li> <li>evaluation of lighting in images where the candidate was responsible for lighting</li> <li>review of case studies to assess knowledge of how to apply lighting techniques in a range of situations</li> <li>written or oral questioning to test knowledge as listed in the required knowledge section of this unit</li> <li>review of portfolios of evidence</li> <li>review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>CUVPHI401A Capture images in response to a brief.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<p><b><i>Subjects</i></b> may include people or objects photographed for purposes, such as:</p>	<ul style="list-style-type: none"> <li>• photo-documentary:             <ul style="list-style-type: none"> <li>• the built environment</li> <li>• the natural environment</li> </ul> </li> <li>• portraiture:             <ul style="list-style-type: none"> <li>• formal</li> <li>• candid</li> </ul> </li> <li>• scientific</li> <li>• medical</li> <li>• technical</li> <li>• still life.</li> </ul>
<p><b><i>Relevant personnel</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• supervisor</li> <li>• manager</li> <li>• client</li> <li>• art director</li> <li>• designer:             <ul style="list-style-type: none"> <li>• set designer</li> <li>• costume designer</li> <li>• production designer</li> </ul> </li> <li>• director</li> <li>• production manager</li> <li>• make-up and hair personnel</li> <li>• model.</li> </ul>
<p><b><i>Lighting equipment and accessories</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• fibre optics</li> <li>• floor pack electronic flash systems</li> <li>• French flags and gobos</li> <li>• light-modifying devices:             <ul style="list-style-type: none"> <li>• scrims</li> <li>• umbrellas</li> <li>• honeycombs and grids</li> <li>• soft boxes</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• reflectors</li> <li>• light absorbers</li> <li>• portable (monobloc type) systems</li> <li>• portable electronic flash</li> <li>• portable photoflood and tungsten light systems</li> <li>• exposure: <ul style="list-style-type: none"> <li>• grey card readings</li> <li>• incident/reflective readings</li> <li>• lighting ratio and brightness range readings</li> <li>• off the film (OTF) and through the lens (TTL) plane metering</li> <li>• spot meter readings</li> </ul> </li> <li>• light-sensitive materials: <ul style="list-style-type: none"> <li>• different types of film and electronic sensors</li> <li>• response of light-sensitive material to different colours of light source</li> </ul> </li> <li>• light sources: <ul style="list-style-type: none"> <li>• candle flame and other ambient low light sources</li> <li>• fluorescent lighting</li> <li>• incandescent, tungsten and photoflood</li> <li>• metallogenic and discharge lamps</li> <li>• ultraviolet and infra-red.</li> </ul> </li> </ul>
<b>Work environment needs</b> may include:	<ul style="list-style-type: none"> <li>• chairs</li> <li>• stools</li> <li>• posing equipment and tables</li> <li>• dust free environment</li> <li>• electricity</li> <li>• lighting: <ul style="list-style-type: none"> <li>• natural/available</li> <li>• studio</li> </ul> </li> <li>• portable equipment and materials: <ul style="list-style-type: none"> <li>• ground sheets</li> <li>• backgrounds</li> <li>• portable generator</li> </ul> </li> <li>• ventilation and air conditioning</li> <li>• work tables</li> <li>• storage areas and facilities.</li> </ul>
<b>Camera systems and accessories</b> may include:	<ul style="list-style-type: none"> <li>• 120 camera</li> <li>• 4 x 5 camera</li> <li>• 35mm SLR camera</li> </ul>



	<ul style="list-style-type: none"> <li>• cable release</li> <li>• digital cameras and backs</li> <li>• exposure meters</li> <li>• film and media</li> <li>• filters</li> <li>• range of lenses</li> <li>• tripods</li> <li>• batteries</li> <li>• camera stands.</li> </ul>
<b><i>Safety considerations</i></b> include:	<ul style="list-style-type: none"> <li>• complying with federal, state and territory legislation, regulations and standards</li> <li>• checking that electrical equipment is correctly tagged and tested</li> <li>• ensuring that the work space is free of trip hazards.</li> </ul>
<b><i>Materials</i></b> may include:	<ul style="list-style-type: none"> <li>• gaffer tape</li> <li>• ground sheets</li> <li>• power cables</li> <li>• multi-outlet power boards for electrical equipment</li> <li>• props</li> <li>• transport cases</li> <li>• equipment bags.</li> </ul>
<b><i>Techniques</i></b> may include:	<ul style="list-style-type: none"> <li>• field of view</li> <li>• framing</li> <li>• dynamic range</li> <li>• composition</li> <li>• background effects</li> <li>• colour balancing and the use of colour temperature meters and filters</li> <li>• combined lighting and the illusion of movement</li> <li>• feathering the light</li> <li>• lighting for silverware</li> <li>• lighting for textured surfaces</li> <li>• lighting glassware and gloss ware</li> <li>• lighting techniques for translucent surfaces</li> <li>• painting with light</li> <li>• shadowless lighting</li> <li>• synchro sun and fill flash</li> <li>• white balance and custom colour optimisation for electronic sensors</li> <li>• techniques for special situations: <ul style="list-style-type: none"> <li>• scientific</li> <li>• technical</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• forensic.</li></ul>
Ways to <i>adjust</i> camera settings for lighting may involve:	<ul style="list-style-type: none"><li>• aperture</li><li>• exposure</li><li>• lens focal length</li><li>• lens hoods</li><li>• shutter speed.</li></ul>

## Unit Sector(s)

Visual communication – photo imaging

## CUVPRP403A Select and organise finished work for storage

### Modification History

Version	Comments
CUVPRP403A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to select finished creative work for storage, to assess storage needs, and to protect and maintain work in storage.

### Application of the Unit

People working in all areas of arts practice apply the skills and knowledge described in this unit. They could be responsible for selecting and organising the storage of finished works in their own practice, at an artist-run studio, or in a gallery, exhibition space or educational institution.

At this level, they would be expected to exercise autonomy and judgement in a range of situations and contexts.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
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ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Assess finished works for storage	1.1 Determine <b><i>criteria</i></b> for selecting finished works to be stored 1.2 Select works for storage based on criteria 1.3 Assess <b><i>storage needs</i></b> of selected works, taking into account their condition and nature
2. Organise storage of finished works	2.1 Identify and select appropriate <b><i>protective materials</i></b> and conditions for storage 2.2 Ensure that correct <b><i>procedures</i></b> are followed to prepare works for storage 2.3 Ensure that works are safely stored in allocated or selected storage spaces
3. Maintain stored works	3.1 Maintain accurate and complete <b><i>records</i></b> of stored finished work 3.2 Protect confidential information and adhere to copyright requirements in the storage of records 3.3 Monitor and review condition of work in storage according to its specific requirements 3.4 Make adjustments to storage arrangements as required

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

Required skills
<ul style="list-style-type: none"> <li>initiative and enterprise skills to develop storage solutions that best address the characteristics of finished works</li> <li>literacy skills to:               <ul style="list-style-type: none"> <li>interpret information related to protecting, storing and maintaining finished creative work</li> </ul> </li> </ul>

<ul style="list-style-type: none"> <li>• keep accurate records of stored works</li> <li>• planning and organising skills to ensure that finished work is prepared and stored according to correct procedures</li> <li>• problem-solving skills to anticipate issues that affect the storage of finished works</li> <li>• self-management skills to prioritise and plan work</li> </ul>
<b>Required knowledge</b>
<ul style="list-style-type: none"> <li>• archival principles and values</li> <li>• security issues associated with storing works</li> <li>• physical properties and capabilities of a range of materials suitable for protecting and storing work in the relevant area of creative practice</li> <li>• record-keeping systems appropriate for storage and retrieval</li> <li>• intellectual property issues for the storage and maintenance of stored work</li> <li>• sustainability issues associated with equipment, tools and materials required for the protection and storage of finished works in the relevant context</li> <li>• OHS procedures in relation to storage and maintenance of finished work</li> </ul>

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• select works for storage according to agreed criteria</li> <li>• organise the safe storage of finished work</li> <li>• demonstrate knowledge of archival principles and values in the maintenance of stored work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• areas suitable for the storage of finished work.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• direct observation of candidate organising the storage of finished works</li> </ul>

	<ul style="list-style-type: none"> <li>• evaluation of items prepared for storage by the candidate</li> <li>• review of records created or maintained by the candidate</li> <li>• discussion and questioning about the care and protection of finished works and the record-keeping system used</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Criteria</i></b> may include:	<ul style="list-style-type: none"> <li>• archival values</li> <li>• available space</li> <li>• client requirements</li> <li>• personal affinity to pieces of work</li> <li>• potential of works to be used as exemplars</li> <li>• potential future use for works</li> <li>• public interest in works</li> <li>• quality of works</li> <li>• quantity and size of works.</li> </ul>
<b><i>Storage needs</i></b> may involve:	<ul style="list-style-type: none"> <li>• consideration of factors related to:             <ul style="list-style-type: none"> <li>• archival values</li> <li>• dampness</li> <li>• dust</li> <li>• electromagnetic fields</li> <li>• fading</li> <li>• fungi</li> <li>• humidity</li> <li>• insects</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• light</li> <li>• light-sensitive characteristics of images</li> <li>• deciding on best form of storage, given the condition of a specific work</li> <li>• simple repairs prior to storage, e.g. to mounted materials</li> <li>• stabilising any damage to prevent deterioration in storage.</li> </ul>
<b><i>Protective materials</i></b> may include:	<ul style="list-style-type: none"> <li>• archival materials</li> <li>• CD cases</li> <li>• characteristics of the materials used in the work, such as: <ul style="list-style-type: none"> <li>• acid free wrapping or mount board</li> <li>• water absorbent</li> <li>• reflective</li> </ul> </li> <li>• enclosures</li> <li>• folders</li> <li>• form of the artwork: <ul style="list-style-type: none"> <li>• upright</li> <li>• flat</li> </ul> </li> <li>• negative sleeves</li> <li>• materials designed to protect fragile objects: <ul style="list-style-type: none"> <li>• padding</li> <li>• tissues</li> <li>• bubble wrap</li> <li>• box framing.</li> </ul> </li> </ul>
<b><i>Procedures</i></b> may include:	<ul style="list-style-type: none"> <li>• protocols for recording and registering stored work, including ethical considerations</li> <li>• use of protective materials</li> <li>• verbal instructions</li> <li>• workplace procedures: <ul style="list-style-type: none"> <li>• safety</li> <li>• security</li> <li>• process-specific procedures</li> <li>• recycling</li> <li>• cost control</li> <li>• reporting.</li> </ul> </li> </ul>
<b><i>Records</i></b> may include:	<ul style="list-style-type: none"> <li>• electronic records, e.g. image archiving software</li> <li>• labelling of work: <ul style="list-style-type: none"> <li>• medium</li> <li>• number</li> <li>• title</li> <li>• year produced</li> </ul> </li> </ul>

	<ul style="list-style-type: none"><li>• list of stored finished works</li><li>• model release</li><li>• permits, contracts containing conditional usage requirements</li><li>• register of all stored and finished works, e.g. date and usage of photographic material</li><li>• slide library.</li></ul>
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## Unit Sector(s)

Industry capability – professional practice



## CUVPRP405A Develop and discuss ideas for own creative work

### Modification History

Version	Comments
CUVPRP405A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to develop and discuss ideas for creative work.

The unit includes research and analysis, as well as the ability to participate in critical and informed discussion with others about creative work

### Application of the Unit

People working across all areas of creative practice apply the skills and knowledge described in this unit. The ability to research, generate and discuss ideas is an integral part of the creative process, and sits alongside the technical skills specific to particular art forms.

This work would usually be carried out under mentored supervision.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Research ideas	<p>1.1 Identify and source <b>information</b> that supports the development of ideas for creative work</p> <p>1.2 <b>Critically analyse</b> information in the context of current and potential work</p>
2. Generate ideas	<p>2.1 Develop a range of different, innovative and creative ideas based on the nature of own creative practice</p> <p>2.2 Reflect on and integrate ideas generated from research</p> <p>2.3 Consider possible <b>constraints</b> on ideas</p> <p>2.4 Select ideas based on research, reflection and relevant constraints</p>
3. Discuss ideas with others	<p>3.1 Identify and seek out <b>people</b> who can provide valuable input to discussions about work ideas</p> <p>3.2 Evaluate different <b>communication options</b> and select the most appropriate</p> <p>3.3 Present key information on ideas and their process of development</p> <p>3.4 Use effective communication techniques to generate discussion, debate and critical analysis of ideas</p>
4. Adjust and refine ideas	<p>3.5 Reflect on the views and contributions of others</p> <p>3.6 Make own analysis of ideas based on individual aspirations and goals</p> <p>3.7 Refine ideas based on own analysis and interactions with others</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to engage in informed discussion about potentially abstract ideas
- critical thinking skills to evaluate, distil and select ideas from research
- learning skills to learn from discussion with others
- literacy skills to interpret a wide range of source materials for the development of ideas

### Required knowledge

- historical and contemporary references in chosen area of practice
- different ways to communicate and collaborate in creative practice
- intellectual property issues and legislation that affect the development of ideas for creative work in the relevant context

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• generate ideas for creative work grounded in research and reflection</li> <li>• engage in informed discussion about ideas in own work</li> <li>• apply knowledge of historical and contemporary references in own area of creative work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• interaction with others about ideas for work.</li> </ul>
<b>Method of assessment</b>	<p>Assessment may incorporate a range of methods to assess performance and the application of essential underpinning knowledge, and might include:</p> <ul style="list-style-type: none"> <li>• evaluation of presentation by the candidate</li> <li>• questioning about research and development processes</li> </ul>

	<ul style="list-style-type: none"> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>• CUVPRP401A Realise a creative project.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Information</b> may include:	<ul style="list-style-type: none"> <li>• direct observation of the natural or built environment</li> <li>• music, film and video</li> <li>• myths and legends</li> <li>• oral history</li> <li>• photographs and other artworks</li> <li>• promotional material</li> <li>• range of texts and text types</li> <li>• technical reports and data.</li> </ul>
Way to <b>critically analyse</b> information may involve:	<ul style="list-style-type: none"> <li>• considering how ideas may be adapted and challenged within work</li> <li>• drawing links between references and own work</li> <li>• making judgements about relevance of information and ideas.</li> </ul>
<b>Constraints</b> may include:	<ul style="list-style-type: none"> <li>• audience</li> <li>• availability of materials, tools and equipment</li> <li>• budgeting</li> <li>• own skills</li> <li>• presentation venue/context</li> <li>• sponsorship</li> <li>• timeframe.</li> </ul>
<b>People</b> may include:	<ul style="list-style-type: none"> <li>• critics and writers</li> <li>• mentors</li> </ul>

	<ul style="list-style-type: none"><li>• other creative practitioners</li><li>• peer groups</li><li>• supervisors</li><li>• teachers.</li></ul>
<i>Communication options</i> may include:	<ul style="list-style-type: none"><li>• blog</li><li>• informal discussions</li><li>• electronic forums</li><li>• oral presentation</li><li>• visual presentation</li><li>• written presentation</li><li>• wiki.</li></ul>

## Unit Sector(s)

Industry capability – professional practice

## CUVPRP501A Realise a body of creative work

### Modification History

Version	Comments
CUVPRP501A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to realise a coherent body of creative work. Practitioners integrate conceptual, technical and organisational skills to create work in their chosen creative form.

### Application of the Unit

Creative practitioners at the beginning of their professional practice apply the skills and knowledge in this unit. They have a well-developed command of materials, process and technique. Completed work conveys strong conceptual and theoretical development.

This unit reflects the integrated creative process that is so important to artistic practice. It may be applied to any creative form and, in practice, is combined with other discipline-specific units that address specialised technical skills.

At this level, work is undertaken independently with mentoring and guidance as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Develop ideas for a coherent body of work	<p>1.1 Establish and explore a <b><i>developing range of sources</i></b> to inform new ideas</p> <p>1.2 Support professional practice by extending knowledge of historical and contemporary references</p> <p>1.3 Evaluate developing ideas and options for creative work using <b><i>critical and creative thinking approaches</i></b></p> <p>1.4 <b><i>Consider the professional potential of ideas</i></b></p> <p>1.5 Where appropriate, refine personal thinking through consultation with <b><i>relevant people</i></b></p> <p>1.6 Develop ideas or designs based on research, reflection and suitability for the intended purpose</p>
2. Plan and organise the production of work	<p>2.1 Confirm the <b><i>scope and objectives of the work</i></b> based on the project concept</p> <p>2.2 Evaluate and organise financial, physical and other resources based on in-depth knowledge of the creative form</p> <p>2.3 Set up or gain access to an appropriate work space</p> <p>2.4 Develop a <b><i>realistic timeframe</i></b> for the production of work</p> <p>2.5 Evaluate and respond to <b><i>project constraints</i></b></p> <p>2.6 Monitor project workflow against the plan</p>
3. Develop own approach to documenting the body of work	<p>3.1 Evaluate <b><i>options for documenting and recording work</i></b> and the ideas and research that inform it</p> <p>3.2 Consider <b><i>information for inclusion</i></b> and the need to reveal the process of work</p> <p>3.3 Select and develop own approach and presentation style</p> <p>3.4 Document production of work from initial ideas to realisation</p>

4. Collaborate with others	<p>4.1 Seek and be open to critical analysis of own work by others</p> <p>4.2 Participate <b><i>critically and knowledgeably</i></b> in conversations that explore different ways of doing things</p> <p>4.3 Explore and experiment with ideas that come from collaboration</p>
5. Create finished work	<p>5.1 Use safe work practices to manipulate selected materials, processes and technologies with increasing confidence and skill</p> <p>5.2 Challenge and test technical and conceptual aspects of the work during production</p> <p>5.3 Finish work to professional standard</p>
6. Evaluate own artwork	<p>6.1 Review work in progress against personal, professional and artistic objectives</p> <p>6.2 Identify and respond to <b><i>opportunities for refinement and re-thinking</i></b></p> <p>6.3 Evaluate <b><i>efficiency and effectiveness</i></b> of the work process</p> <p>6.4 Evaluate finished work in terms of its <b><i>coherence with the project concept</i></b>, technical resolution and suitability for the intended purpose</p>

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

- communication skills to:
  - collaborate with others as part of the creative process
  - discuss abstract ideas with others
  - create a professional documentation of work
- critical thinking and analytical skills to:
  - evaluate, distil and select ideas for application to own work
  - evaluate own work in terms of its coherence
- initiative and enterprise skills to develop ideas and create work that responds to creative and professional objectives
- learning skills to:
  - receive and integrate constructive criticism from others
  - engage in an ongoing process of skills development
- literacy skills to:
  - interpret information dealing with complex or abstract ideas



- document work in ways that communicate processes and ideas
- numeracy skills to manage project costs
- problem-solving skills to creatively resolve conceptual and technical issues that arise within the work
- self-management and planning skills to plan and coordinate a creative project from initial concept to realisation
- technical skills to apply, adapt and refine specialised skills relevant to the particular creative form

### Required knowledge

- relationship between technique, materials and process in the relevant creative form
- cultural, sociological, philosophical, aesthetic, political and commercial influences on chosen area of work, in historical and contemporary contexts
- critical and creative thinking techniques and how they work in the context of creative practice
- professional opportunities in the relevant area of creative practice
- typical problems that occur during the production of a body of creative work, and how to avoid or resolve them
- commonly used research methodologies for creative practitioners
- current and emerging practice for documenting work in a creative context
- basic project management techniques, particularly in relation to work planning, time management and resource management
- intellectual property issues and legislation associated with professional creative practice
- sustainability issues associated with the tools and materials used in the chosen creative form
- organisational and legislative OHS procedures in relation to chosen creative form

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

Overview of assessment	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• create a coherent body of creative work that is technically and conceptually resolved, is consistent with the project concept, and is finished to a professional standard</li> <li>• consider the professional potential for proposed work</li> </ul>

	<ul style="list-style-type: none"> <li>document the work creatively from initial idea to realisation</li> <li>evaluate and discuss work in an informed way</li> <li>use safe and sustainable work practices.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>appropriate resources for the production of work, including work space, tools, equipment and materials</li> <li>studio and workshop facilities.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>evaluation of a body of work produced by the candidate</li> <li>evaluation of processes used by the candidate to conceive, plan and realise the work</li> <li>direct observation of work in progress</li> <li>group peer review of the work</li> <li>evaluation of a candidate's visual diary or other forms of documentation showing the development of the work</li> <li>questioning and discussion about candidate's intentions and the work outcome</li> <li>review of portfolios of evidence</li> <li>review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, for example:</p> <ul style="list-style-type: none"> <li>specialisation units for any creative form.</li> </ul>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<p><b><i>A developing range of sources</i></b> provides access to:</p>	<ul style="list-style-type: none"> <li>• ideas that challenge own work to date</li> <li>• in-depth exploration of ideas already touched on</li> <li>• previously unexplored ideas</li> <li>• uses of new techniques, materials or processes</li> <li>• ideas that challenge own beliefs.</li> </ul>
<p><b><i>Sources</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• art critics</li> <li>• art history texts</li> <li>• artworks</li> <li>• cultural theorists</li> <li>• design ideas</li> <li>• exhibitions</li> <li>• films</li> <li>• galleries</li> <li>• images</li> <li>• internet</li> <li>• journal articles</li> <li>• museums</li> <li>• myths and legends</li> <li>• objects</li> <li>• oral history</li> <li>• own experience</li> <li>• performances</li> <li>• presentations</li> <li>• philosophers</li> <li>• social commentators</li> <li>• technical or medium-specific information</li> <li>• writings.</li> </ul>
<p><b><i>Critical and creative thinking approaches</i></b> may include:</p>	<ul style="list-style-type: none"> <li>• blog or wiki</li> <li>• brainstorming</li> <li>• daydreaming and mental wandering</li> <li>• discussion</li> <li>• Edward de Bono's Six Thinking Hats</li> <li>• graphic organisers:             <ul style="list-style-type: none"> <li>• concept fans</li> <li>• visual maps</li> <li>• webbing</li> </ul> </li> <li>• lateral thinking games</li> <li>• making associations</li> <li>• mind mapping</li> <li>• morphological analysis</li> <li>• sketching</li> </ul>

	<ul style="list-style-type: none"> <li>• social networking</li> <li>• storytelling</li> <li>• sub-culture surfing</li> <li>• trigger words</li> <li>• use of metaphors and analogies</li> <li>• vision circles</li> <li>• visualisation</li> <li>• wishful thinking</li> <li>• word salads.</li> </ul>
<b>Professional potential</b> may relate to:	<ul style="list-style-type: none"> <li>• collaboration</li> <li>• market trends</li> <li>• professional development</li> <li>• saleability.</li> </ul>
<b>Relevant people</b> may include:	<ul style="list-style-type: none"> <li>• employers</li> <li>• mentors</li> <li>• other creative practitioners</li> <li>• peers</li> <li>• potential customers</li> <li>• teachers.</li> </ul>
<b>Scope and objectives of the work</b> may relate to:	<ul style="list-style-type: none"> <li>• brief for the work</li> <li>• competition criteria</li> <li>• creative criteria</li> <li>• ideas to be communicated</li> <li>• number of items to be produced</li> <li>• potential to exhibit and sell</li> <li>• self-development potential</li> <li>• time for creation.</li> </ul>
<b>Realistic timeframe</b> takes account of:	<ul style="list-style-type: none"> <li>• availability of materials</li> <li>• client needs</li> <li>• complexity of the work</li> <li>• other commitments</li> <li>• potential for external factors to impact</li> <li>• sponsor requirements.</li> </ul>
<b>Project constraints</b> may include:	<ul style="list-style-type: none"> <li>• availability of outsourced production or assistance</li> <li>• budget</li> <li>• client preferences</li> <li>• potential for burn-out</li> <li>• public safety</li> <li>• safety requirements</li> <li>• saleability</li> <li>• technical skills and knowledge</li> </ul>

	<ul style="list-style-type: none"> <li>time.</li> </ul>
<b><i>Options for documenting and recording work</i></b> may include:	<ul style="list-style-type: none"> <li>blog or wiki</li> <li>digital presentations</li> <li>maquettes</li> <li>notes and other written text</li> <li>online forum</li> <li>photographic record</li> <li>physical portfolio</li> <li>practice pieces</li> <li>verbal presentation</li> <li>visual diary.</li> </ul>
<b><i>Information for inclusion</i></b> may include:	<ul style="list-style-type: none"> <li>challenges encountered</li> <li>intellectual property considerations</li> <li>development of techniques</li> <li>early ideas</li> <li>external references and sources</li> <li>input from others</li> <li>refinement processes for ideas and techniques</li> <li>use of materials and processes</li> <li>work log, including time and expenses.</li> </ul>
<b><i>Critically and knowledgably</i></b> may include:	<ul style="list-style-type: none"> <li>familiarity with the work of others</li> <li>knowledge of materials, process and technique</li> <li>substantiated ideas and positions.</li> </ul>
<b><i>Opportunities for refinement and re-thinking</i></b> may relate to:	<ul style="list-style-type: none"> <li>collaboration</li> <li>ideas</li> <li>materials</li> <li>market demand</li> <li>processes</li> <li>techniques</li> <li>workflow.</li> </ul>
<b><i>Efficiency and effectiveness</i></b> may relate to:	<ul style="list-style-type: none"> <li>aesthetic or functional quality of the work</li> <li>completion on budget</li> <li>completion on time</li> <li>positive or negative impact on own health</li> <li>success in communicating ideas</li> <li>technical standard of work.</li> </ul>
<b><i>Coherence with the project concept</i></b> may relate to:	<ul style="list-style-type: none"> <li>connection of ideas within the work</li> <li>connections or divergence in process between initial concept and final product</li> <li>materials</li> <li>processes</li> </ul>

	<ul style="list-style-type: none"><li>• techniques.</li></ul>
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## Unit Sector(s)

Industry capability – professional practice

## CUVPRP502A Prepare for sustainable professional practice

### Modification History

Version	Comments
CUVPRP502A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to establish professional practice goals and to determine how practice can be developed in a sustainable way. A sustainable practice is one that takes account of all aspects of sustainability – individual, social, environmental and economic.

### Application of the Unit

Professional practitioners across all sectors and areas of expertise must consider the sustainability of their practice.

At this level, an individual is beginning the journey of establishing a professional practice. This is a largely self-directed activity, but may involve some mentoring and guidance as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Develop own practice goals	<p>1.1 Reflect on professional <b><i>goals and aspirations</i></b> in the context of chosen area of practice</p> <p>1.2 Identify and make contact with <b><i>key people</i></b> to support individual reflection</p> <p>1.3 Evaluate <b><i>factors that affect contemporary practice</i></b> in chosen area, including specific opportunities</p> <p>1.4 <b><i>Question</i></b> self and others about future directions for practice</p> <p>1.5 Look for opportunities and ideas <b><i>beyond the obvious</i></b></p> <p>1.6 Develop goals that take account of <b><i>individual personal circumstances</i></b></p> <p>1.7 Make decisions about overall practice direction, based on reflection and research</p>
2. Identify key sustainability issues	<p>2.1 Identify and investigate the <b><i>key components of sustainable professional practice</i></b> in chosen area of work</p> <p>2.2 Evaluate current practice and determine <b><i>opportunities to enhance sustainability</i></b></p> <p>2.3 Research and collate <b><i>information</i></b> to support future professional practice</p>
3. Take action to develop sustainable individual practice	<p>3.1 Develop practical and innovative strategies to enhance sustainability of practice</p> <p>3.2 Develop and nurture own professional networks</p> <p>3.3 Engage in sustainable work practices in all areas of activity</p> <p>3.4 Recognise and integrate the idea of lifelong learning into practice</p> <p>3.5 Engage in ongoing <b><i>collaboration</i></b> with peers and others</p> <p>3.6 Challenge and refine own ideas and strategies for developing</p>



	professional practice
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## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to collaborate with others on practice development issues
- critical thinking and analytical skills to reflect on complex issues and make judgements and decisions about those issues
- initiative and enterprise skills to develop new ideas for developing sustainable practice
- learning and self-management skills to engage in and commit to an ongoing process of professional development and lifelong learning
- literacy skills to interpret varied information dealing with complex issues from a range of sources
- numeracy skills to investigate issues around financial viability of own practice
- planning and organising skills to develop and action strategies for overall practice development
- problem-solving skills to adjust to constraints and limitations
- technology skills to use the internet as a research tool

### Required knowledge

- professional context for a given area of practice in terms of opportunities and constraints
- tools, techniques and strategies used by practitioners to build sustainable practice
- professional opportunities in own area of practice, across other areas of related practice and across the business and community more generally
- intellectual property issues and legislation and how they impact on the operation of a professional practice
- key aspects of individual, social, economic, environmental sustainability, and how they impact on a particular area of practice

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• develop realistic goals for own practice grounded in research and reflection</li> <li>• develop a set of actions to enhance the sustainability of individual practice</li> <li>• apply knowledge of key aspects of individual, social, economic and environmental sustainability.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• industry networks and information.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of presentation or documentation prepared by the candidate detailing goals and plans to achieve a sustainable practice</li> <li>• questioning and discussion about candidate's professional plans</li> <li>• participation in discussions with the candidate and others about sustainable practice in a given area</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Goals and aspirations</i></b> may relate to:	<ul style="list-style-type: none"> <li>• creative impulse</li> <li>• desire for collaboration</li> <li>• exhibition or performance ambitions</li> <li>• employment within public or private organisations</li> <li>• income</li> <li>• lifestyle</li> <li>• locations for work</li> <li>• professional credibility</li> <li>• professional networks</li> <li>• self-employment</li> <li>• status.</li> </ul>
<b><i>Key people</i></b> may include:	<ul style="list-style-type: none"> <li>• community Elders</li> <li>• family members</li> <li>• mentors</li> <li>• peers</li> <li>• potential customers</li> <li>• potential employers</li> <li>• professional associations</li> <li>• recruitment agencies</li> <li>• teachers.</li> </ul>
<b><i>Factors that affect contemporary practice</i></b> may be:	<ul style="list-style-type: none"> <li>• buying trends</li> <li>• current concerns in the community</li> <li>• economic</li> <li>• ideological</li> <li>• impacts of technology on practice</li> <li>• lifestyle trends</li> <li>• location of practice</li> <li>• political climate</li> <li>• social issues.</li> </ul>
<b><i>Questions</i></b> may be:	<ul style="list-style-type: none"> <li>• am I good enough?</li> <li>• does my family life support my aspirations?</li> <li>• how do other creative practitioners do this?</li> <li>• how much money do I need?</li> <li>• how quickly do I want to achieve it?</li> <li>• what are the opportunities in my local market?</li> <li>• what do I need to learn now and over time?</li> <li>• what do I want to achieve?</li> <li>• who do I need to talk to?</li> </ul>
Opportunities <b><i>beyond the obvious</i></b> may include opportunities:	<ul style="list-style-type: none"> <li>• across disciplines and genres</li> <li>• in community service or health contexts</li> <li>• in industries across the full spectrum of the economy</li> </ul>

	<ul style="list-style-type: none"> <li>• involving collaboration with professionals in different sectors</li> <li>• using new and emerging materials and technologies.</li> </ul>
<b><i>Individual personal circumstances</i></b> may relate to:	<ul style="list-style-type: none"> <li>• availability of time for developing practice</li> <li>• ability to further develop skills</li> <li>• family obligations</li> <li>• financial needs</li> <li>• geography and location</li> <li>• health</li> <li>• lifestyle objectives</li> <li>• scope of existing skills</li> <li>• work / life balance.</li> </ul>
<b><i>Key components of sustainable professional practice</i></b> are:	<ul style="list-style-type: none"> <li>• economic: <ul style="list-style-type: none"> <li>• financially viable</li> <li>• job opportunities</li> <li>• sound financial management</li> </ul> </li> <li>• environmental: <ul style="list-style-type: none"> <li>• effective use of physical resources</li> <li>• minimisation of waste</li> <li>• protection of the physical environment</li> <li>• use of alternative materials and processes</li> </ul> </li> <li>• human: <ul style="list-style-type: none"> <li>• lifelong learning</li> <li>• own professional development</li> <li>• personal health and nutrition</li> <li>• safety of self</li> <li>• stress management</li> </ul> </li> <li>• social: <ul style="list-style-type: none"> <li>• acknowledgment of the intellectual property of others</li> <li>• legal activity</li> <li>• community engagement</li> <li>• safety of others</li> <li>• social responsibility, such as taxation.</li> </ul> </li> </ul>
<b><i>Opportunities to enhance sustainability</i></b> may include:	<ul style="list-style-type: none"> <li>• additional safety measures in work space</li> <li>• adopting new technology as a habit</li> <li>• applying for grants</li> <li>• applying for employment with arts organisations</li> <li>• establishing new networks</li> <li>• greater collaboration with others</li> <li>• further study and skill development</li> <li>• identifying philanthropic opportunities</li> </ul>

	<ul style="list-style-type: none"><li>• improved nutrition</li><li>• improved marketing and promotion</li><li>• effective financial management systems</li><li>• seeking assistance from experts</li><li>• setting up shared studio space.</li></ul>
<b>Information</b> may include:	<ul style="list-style-type: none"><li>• business planning advice</li><li>• ideas, self-generated or from others</li><li>• industry publications</li><li>• marketing advice</li><li>• promotional ideas</li><li>• taxation information</li><li>• training opportunities.</li></ul>
<b>Collaboration</b> may involve:	<ul style="list-style-type: none"><li>• engaging in professional networks</li><li>• participating in a community of practice</li><li>• sharing ideas and information</li><li>• working on joint projects.</li></ul>

## Unit Sector(s)

Industry capability – professional practice

## CUVPRP503A Present a body of own creative work

### Modification History

Version	Comments
CUVPRP503A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to use creative, technical and project management skills to develop a professional and innovative presentation of own creative work. It is based on the unit CUVPHI520A Produce an innovative presentation of professional work.

### Application of the Unit

All creative practitioners need to produce, present and continually update a professional presentation package or portfolio of their own creative work. The presentation may be physical or virtual.

Work is undertaken independently with mentoring and guidance as required.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Evaluate and select presentation options	<p>1.1 Research <b><i>presentation options</i></b> using appropriate <b><i>sources of information</i></b></p> <p>1.2 Explore ideas and options for presenting work in <b><i>new and innovative ways</i></b>, including those from other disciplines</p> <p>1.3 Identify and consult with <b><i>relevant people</i></b> when developing presentation options</p> <p>1.4 Select presentation methodologies based on <b><i>intended purpose</i></b> and <b><i>other parameters</i></b></p>
2. Plan presentation of work	<p>2.1 Use <b><i>critical thinking techniques</i></b> to develop an overall presentation concept</p> <p>2.2 Explore and refine how the presentation concept will impart explicit and implicit messages to its audience</p> <p>2.3 Develop realistic production budget, timeline and workflow plan</p> <p>2.4 Design a <b><i>template</i></b> for the presentation that supports key messages to be communicated</p>
3. Create presentation	<p>3.1 Select and integrate <b><i>content</i></b> that supports presentation objectives</p> <p>3.2 Obtain and accurately record copyright clearance on all sourced content</p> <p>3.3 Develop a cohesive presentation that supports objectives</p> <p>3.4 Review projected and actual budget outcomes</p>
4. Review and update presentation	<p>4.1 Evaluate presentation in the context of its objectives and feedback from others</p> <p>4.2 Proactively identify opportunities to update and refine presentation</p> <p>4.3 Develop systems to identify and respond to future presentation opportunities</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to impart key messages about own creative work to the intended audience
- critical thinking and analytical skills to analyse and evaluate different options for presentation of work, including current and emerging professional trends
- initiative and enterprise skills to identify and act on new ideas for presenting work
- learning and self-management skills to keep up-to-date with emerging and innovative practice in professional presentation of work
- literacy skills to create a coherent presentation of work
- planning and organising skills to:
  - manage the workflow for the production of a portfolio of work (research, concept development, production and post-production)
  - organise resources required for the portfolio
- problem-solving skills to develop solutions for conceptual and technical challenges
- numeracy skills to estimate costs for presentation production
- technology skills to use digital media, design and presentation technologies appropriate to the creative work being presented

### Required knowledge

- typical and innovative ways in which portfolios of work are used by creative practitioners
- visual communication formats relevant to the presentation of creative work
- current and emerging trends in presentation technologies relevant to the particular area of work (including design, layout, typography, interactivity and accessibility)
- elements and principles of design as they apply to the creation of a professional presentation of work
- intellectual property issues and legislation and how they relate to the use of information in a professional presentation

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*



<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• research industry-standard presentation methodologies</li> <li>• design and realise presentation concepts</li> <li>• present creative products in a manner suited to the intended audience and purpose.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• appropriate technology and sources of information to research industry-standard presentation methodologies</li> <li>• industry-standard presentation packages and technology.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of a presentation or portfolio created by the candidate</li> <li>• direct observation of candidate presenting creative products</li> <li>• evaluation of problem-solving activities to assess candidate's critical thinking skills</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Presentation options</i></b> may include:	<ul style="list-style-type: none"> <li>• bound books and folios</li> <li>• brochures</li> <li>• catalogues</li> </ul>
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	<ul style="list-style-type: none"> <li>• digital media presentations, including websites</li> <li>• exhibitions of work in a variety of display spaces</li> <li>• product demonstration</li> <li>• product sample cases</li> <li>• promotional folders</li> <li>• printed images, bound in book form or in folios.</li> </ul>
<b><i>Sources of information</i></b> may include:	<ul style="list-style-type: none"> <li>• books</li> <li>• discussions with industry practitioners</li> <li>• events</li> <li>• government bodies</li> <li>• industry associations</li> <li>• internet</li> <li>• libraries and archives</li> <li>• journals</li> <li>• media</li> <li>• personal observations and experience</li> <li>• professional development sources: <ul style="list-style-type: none"> <li>• awards</li> <li>• competitions</li> <li>• conferences</li> <li>• exhibitions</li> <li>• master classes</li> </ul> </li> <li>• suppliers of products and services</li> <li>• technical publications.</li> </ul>
<b><i>New and innovative ways</i></b> may include:	<ul style="list-style-type: none"> <li>• interactivity</li> <li>• media not used before</li> <li>• new distribution mechanisms</li> <li>• storytelling or other interpretive techniques.</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• members of relevant professional associations</li> <li>• mentors and peers</li> <li>• practising artists and designers</li> <li>• presentation experts</li> <li>• teachers.</li> </ul>
<b><i>Intended purpose</i></b> may be:	<ul style="list-style-type: none"> <li>• application submission: <ul style="list-style-type: none"> <li>• association membership</li> <li>• grant/commission</li> <li>• industry accreditation</li> </ul> </li> <li>• artistic</li> <li>• commercial</li> <li>• educational</li> <li>• entertainment</li> </ul>

	<ul style="list-style-type: none"> <li>• job interview</li> <li>• marketing/promotion</li> <li>• promotional give-away to prospective clients.</li> </ul>
<b>Other parameters</b> may relate to:	<ul style="list-style-type: none"> <li>• budgetary constraints</li> <li>• competition rules</li> <li>• environmental sustainability</li> <li>• grant application requirements</li> <li>• longevity requirements</li> <li>• requirements of a brief</li> <li>• time constraints</li> <li>• viewing locations</li> <li>• viewing requirements.</li> </ul>
<b>Critical thinking techniques</b> may include:	<ul style="list-style-type: none"> <li>• analysing and evaluating actions and policies</li> <li>• clarifying issues, values and standards</li> <li>• comparing similar situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• reading and listening critically</li> <li>• recognising contradictions</li> <li>• transferring insights to new contexts</li> <li>• using critical vocabulary.</li> </ul>
<b>Template</b> may include:	<ul style="list-style-type: none"> <li>• chapter and section headings</li> <li>• colour scheme</li> <li>• outline script</li> <li>• image specifications</li> <li>• layout and design</li> <li>• thematic connections</li> <li>• typography to be used.</li> </ul>
<b>Content</b> may include:	<ul style="list-style-type: none"> <li>• audio, video and DVD sequences</li> <li>• drawings</li> <li>• illustrations</li> <li>• maquettes and other three-dimensional (3-D) forms</li> <li>• paintings</li> </ul>

	<ul style="list-style-type: none"><li>• photo images.</li></ul>
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## Unit Sector(s)

Industry capability – professional practice

## CUVPRP601A Originate a body of independent creative work

### Modification History

Version	Comments
CUVPRPR601A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to independently conceive, plan and realise a coherent body of creative work at a professional level.

### Application of the Unit

Creative practitioners at this level have a capacity for independent thought and self-direction that allows them to conceive, plan and realise a body of work of a professional standard. They engage with peers and industry networks in ways that develop and confirm their place as arts professionals. Their command of materials, process and technique is highly developed. This unit may be applied to any creative form.

This unit lies at the heart of artistic practice and reflects processes of experimentation, refinement and maturation at both a conceptual and technical level.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Evolve conceptual thinking	<p>1.1 Identify the potential for <b><i>individualised or specialised research</i></b> based on current practice</p> <p>1.2 Investigate <b><i>new sources and research opportunities</i></b></p> <p>1.3 Reflect on own practice to evolve personal ideas</p> <p>1.4 Challenge assumptions, preconceptions and norms to stretch the boundaries of own thinking</p> <p>1.5 Use <b><i>critical analysis</i></b> to evolve own ideas and develop innovative approaches</p> <p>1.6 Hone and adapt ideas for work based on emerging ideas and research</p>
2. Seek professional opportunities and engagement	<p>2.1 Pursue opportunities for professional work based on <b><i>established goals and aspirations</i></b></p> <p>2.2 Evaluate potential <b><i>commercial opportunities</i></b> as part of a viable professional practice</p> <p>2.3 Engage with <b><i>professionals within and outside the arts community</i></b> to further develop own ideas, professional identity and opportunities for work</p> <p>2.4 Establish <b><i>sustainable ways to support ongoing professional engagement</i></b></p>
3. Plan an independent project	<p>3.1 Integrate individual research, personal ideas and professional realities to confirm the concept for a body of creative work</p> <p>3.2 Develop and implement a <b><i>sustainable project management approach</i></b> for the work</p> <p>3.3 Consider and integrate the promotion, exhibition and communication of the work in the planning process</p>

4. Realise the body of creative work	<p>4.1 Integrate command of technique, materials and process to create finished work of professional standard suitable for the public domain</p> <p>4.2 Deepen individual engagement with techniques, ideas and the relationships between them</p> <p>4.3 Apply critical and creative thinking to challenge, adapt and refine the creative work</p> <p>4.4 Further evolve and refine ideas through processes of experimentation and exploration</p> <p>4.5 Bring together the disparate challenges of the project to complete work on time</p>
5. Evaluate professional work	<p>5.1 Seek and apply <i>constructive criticism</i> from others to improve own work</p> <p>5.2 Evaluate work against planned strategy for own creative practice</p> <p>5.3 Evaluate own work in the context of work by others to extend own practice</p> <p>5.4 Adjust work processes and practice as necessary to improve technical, conceptual and commercial outcomes</p>

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills
<ul style="list-style-type: none"> <li>communication skills to engage with others at a professional level</li> <li>critical thinking and analytical skills to: <ul style="list-style-type: none"> <li>independently analyse and evaluate ideas to inform original work</li> <li>evaluate own work in terms of its coherence and its place in a professional practice</li> </ul> </li> <li>initiative and enterprise skills to independently generate new ideas and work opportunities</li> <li>learning skills to evaluate own skills against professional practice strategy</li> <li>literacy skills to: <ul style="list-style-type: none"> <li>interpret information dealing with complex or abstract ideas</li> <li>document work in ways that communicate processes and ideas</li> </ul> </li> <li>numeracy skills to calculate project costs</li> <li>problem-solving skills to: <ul style="list-style-type: none"> <li>challenge, adapt and refine work projects</li> </ul> </li> </ul> <p>creatively resolve conceptual and technical issues that arise within the work</p> <ul style="list-style-type: none"> <li>self-management and planning skills to plan and coordinate an independent project from initial concept to realisation</li> </ul>

- technical skills to apply and adapt specialised skills related to particular creative form

### Required knowledge

- scope of research potential for professional artists within and beyond traditional creative areas
- relationship between ideas, technique, materials and process in the relevant art form
- cultural, sociological, philosophical, aesthetic, political and commercial influences on chosen area of work, in historical and contemporary contexts
- critical and creative thinking techniques and how they work in the context of creative practice
- commercial and professional opportunities for creative work in the context of own practice
- typical problems that occur during the production of a body of creative work, and how to avoid or resolve them
- project management methodologies
- intellectual property issues and legislation associated with artistic professional practice
- sustainability issues associated with the tools and materials used in the chosen creative form
- organisational and legislative OHS procedures in relation to chosen creative form

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• independently originate and realise a coherent body of creative work that effectively communicates the concept</li> <li>• create work of a professional standard for sale, promotion or use in the public domain</li> <li>• independently plan and monitor a creative project</li> <li>• articulate and present ideas about the work</li> <li>• evaluate and discuss work in a professional context.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• appropriate resources for the production of work, including work space, tools, equipment and materials.</li> </ul>
<b>Method of assessment</b>	A range of assessment methods should be used to assess practical



	<p>skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of a body of work produced by the candidate</li> <li>• evaluation of processes used by the candidate to independently conceive, plan and realise the work</li> <li>• direct observation of work in progress</li> <li>• evaluation of a candidate's visual diary or other forms of documentation showing the development of the work, including research and ideas development</li> <li>• group peer review of the work</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Individualised or specialised research</i></b> may involve:	<ul style="list-style-type: none"> <li>• in-depth focus on a particular: <ul style="list-style-type: none"> <li>• idea</li> <li>• material</li> <li>• medium</li> <li>• process</li> <li>• technique</li> </ul> </li> <li>• investigation of a perceived deficiency in own work</li> <li>• intensive mentoring with a more experienced peer.</li> </ul>
<b><i>New sources and</i></b>	<ul style="list-style-type: none"> <li>• analysis of greater subtlety and distinction</li> </ul>

<p><b><i>research opportunities</i></b> may relate to:</p>	<ul style="list-style-type: none"> <li>• areas of research not already explored</li> <li>• component resourcing</li> <li>• consumer trends</li> <li>• current business theories</li> <li>• emerging government policy</li> <li>• emerging research</li> <li>• fashion/design trends</li> <li>• individuals in any fields of endeavour</li> <li>• innovative organisations</li> <li>• international trends</li> <li>• research in greater depth</li> <li>• research of broader scope</li> <li>• social trends.</li> </ul>
<p><b><i>Critical analysis</i></b> may involve:</p>	<ul style="list-style-type: none"> <li>• adapting</li> <li>• analysing and evaluating actions and policies</li> <li>• challenging</li> <li>• clarifying issues, values and standards</li> <li>• comparing similar situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• critical path process</li> <li>• debate and discussion</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• judging</li> <li>• leap of faith</li> <li>• making connections between seemingly unrelated information</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• openness</li> <li>• questioning</li> <li>• reading and listening critically.</li> </ul>
<p><b><i>Established goals and aspirations</i></b> may be:</p>	<ul style="list-style-type: none"> <li>• commercial</li> <li>• creative</li> <li>• developmental</li> <li>• philosophical</li> <li>• political</li> <li>• social.</li> </ul>

<b><i>Commercial opportunities</i></b> may include:	<ul style="list-style-type: none"> <li>• collaborative projects</li> <li>• industrial applications</li> <li>• innovative exhibitions</li> <li>• new commercial outlets</li> <li>• public art projects.</li> </ul>
<b><i>Professionals within and outside the arts community</i></b> may include:	<ul style="list-style-type: none"> <li>• architects</li> <li>• business people</li> <li>• coaches</li> <li>• community services professionals</li> <li>• engineers</li> <li>• government officers</li> <li>• mentors</li> <li>• politicians</li> <li>• scientists</li> <li>• technology experts.</li> </ul>
<b><i>Sustainable ways to support ongoing professional engagement</i></b> may include:	<ul style="list-style-type: none"> <li>• engaging in community arts activities</li> <li>• establishing professional networks</li> <li>• joining professional associations</li> <li>• participating in cultural debates</li> <li>• speaking at arts events.</li> </ul>
<b><i>Sustainable project management approach</i></b> would include:	<ul style="list-style-type: none"> <li>• a professional project management plan, including: <ul style="list-style-type: none"> <li>• contingency planning</li> <li>• internal and external resources</li> <li>• objectives and scope</li> <li>• risk management</li> <li>• timelines</li> </ul> </li> <li>• monitoring and adjusting the plan to complete work on time and within budget.</li> </ul>
<b><i>Constructive criticism</i></b> may involve criticism in terms of:	<ul style="list-style-type: none"> <li>• aesthetics</li> <li>• philosophical foundations</li> <li>• social context</li> <li>• technique.</li> </ul>

## Unit Sector(s)

Industry capability – professional practice

## CUVPRP602A Collaborate in professional creative projects

### Modification History

Version	Comments
CUVPRP602A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to collaborate in creative projects as a professional practitioner. It includes the establishment, realisation and evaluation of collaborative projects.

### Application of the Unit

Independent creative practitioners apply the skills and knowledge in this unit, and collaboration is often an integral part of creative practice. Practitioners may collaborate on commercial or community projects in physical or virtual environments. They may work together on individual pieces of work or on thematically connected works in the broader context of a work brief, exhibition, competition or themed event. Projects may be self-generated or developed in response to opportunities presented by others.

This activity is self-directed.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Embrace collaboration as part of professional practice	<p>1.1 Establish and maintain sustainable relationships based on mutual respect and trust</p> <p>1.2 Cultivate <b><i>collaborative communities and partnerships</i></b> based on the <b><i>potential benefits</i></b> for self and others</p> <p>1.3 Reflect on the <b><i>blockers</i></b> to effective collaboration and adopt personal philosophies and behaviours in response</p> <p>1.4 Identify and pursue <b><i>opportunities for collaboration</i></b></p>
2. Establish collaborative projects	<p>2.1 Establish shared understandings of project <b><i>objectives and parameters</i></b></p> <p>2.2 Agree on ways of working that acknowledge the <b><i>different contributions</i></b> of those involved</p> <p>2.3 Acknowledge and integrate ethical approaches to questions of intellectual property for creative content</p> <p>2.4 Identify and respond to <b><i>professional and practical project considerations</i></b></p> <p>2.5 Organise and allocate work activities in a cost-effective and equitable manner with clear, agreed outcomes</p>

3. Realise collaborative projects	<p>3.1 Demonstrate a high standard of personal engagement and professionalism to promote the confidence and support of others</p> <p>3.2 Contribute and share own technical and creative expertise from ideas generation to final project realisation</p> <p>3.3 Identify and act on opportunities to extend own expertise and learn from others as projects progress</p> <p>3.4 Challenge, test and share ideas in a supportive way</p> <p>3.5 Embrace technical, creative and organisational challenges and take responsibility for finding new ideas and solutions</p> <p>3.6 Honour own commitments and take responsibility for project outcomes</p>
4. Evaluate collaborative projects	<p>4.1 Engage in an open process of <i>review and evaluation</i> with others involved in projects</p> <p>4.2 Reflect on own level of participation, relationships with others, and personal behaviour</p> <p>4.3 Identify and seek opportunities to refine and expand own expertise</p>

## Required Skills and Knowledge

### Required skills

- communication skills to:
  - establish and maintain sustainable professional relationships through open and supportive communication in all project stages
  - collaborate on complex issues, ideas and creative challenges
  - encourage others in a collaborative process through effective modelling
- critical thinking and analytical skills to reflect on complex creative, technical and organisational issues and make judgements and decisions about those issues
- initiative and enterprise skills to identify and pursue professional work opportunities
- learning and self-management skills to independently progress a complex project and use the collaborative process as a development tool
- literacy skills to interpret and share varied information dealing with at times complex issues
- planning and organising skills to participate professionally in the set-up, monitoring and completion of a professional collaborative project
- problem-solving skills to evaluate and resolve complex problems of a technical, creative or organisational nature in a collaborative way

**Required knowledge**

- types of behaviours that support effective collaborative relationships
- benefits of collaboration for individuals, businesses and communities, including the value of collaboration as a problem-solving tool
- typical blockers to the collaborative process, particularly in a creative context
- different roles played by people in a collaborative process
- types of collaboration and collaborative projects that apply to particular areas of creative practice
- key project management systems and procedures that apply to any project
- typical problems encountered in a collaborative process and how they may be avoided or resolved
- ways of evaluating projects in terms of their success as collaborative undertakings
- intellectual property issues that affect the development of creative content, including the concept of shared intellectual property

**Evidence Guide**

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• engage with the technical, creative and organisational aspects of a collaborative project to realise creative work of a professional standard</li> <li>• make positive contributions to the collaborative effort by modelling ethical behaviour</li> <li>• use the collaborative process as a means of extending own expertise.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• active participation with others in a professional creative project.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of a body of creative work realised by the candidate as part of a collaborative effort</li> </ul>

	<ul style="list-style-type: none"> <li>• evaluation of presentation or documentation prepared by the candidate detailing the processes and outcomes of a collaborative creative project</li> <li>• questioning and discussion about candidate's participation in the project</li> <li>• participation in discussions with the candidate and others about the project</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Collaborative communities and partnerships</i></b> may include:	<ul style="list-style-type: none"> <li>• communities of practice</li> <li>• formal and informal relationships</li> <li>• formal and informal groups in collaborative relationships</li> <li>• knowledge communities</li> <li>• knowledge networks</li> <li>• learning communities</li> <li>• physical or virtual relationships</li> <li>• supply chain communities</li> <li>• virtual circles.</li> </ul>
<b><i>Potential benefits</i></b> may include:	<ul style="list-style-type: none"> <li>• capacity to undertake particular projects</li> <li>• community engagement</li> <li>• exploration of new art forms or media</li> <li>• increased professional profile</li> <li>• learning from others</li> </ul>



	<ul style="list-style-type: none"> <li>• new sources of ideas.</li> </ul>
<b>Blockers</b> may include:	<ul style="list-style-type: none"> <li>• concerns about loss of intellectual property</li> <li>• cultural considerations</li> <li>• fear</li> <li>• lack of trust</li> <li>• prejudice</li> <li>• unwillingness to share.</li> </ul>
<b>Opportunities for collaboration</b> may include:	<ul style="list-style-type: none"> <li>• community art or design projects</li> <li>• competition entries</li> <li>• consortia bids for work</li> <li>• exhibitions</li> <li>• public art</li> <li>• transdisciplinary projects.</li> </ul>
<b>Objectives and parameters</b> may be:	<ul style="list-style-type: none"> <li>• aesthetic</li> <li>• community participation</li> <li>• creative</li> <li>• financial</li> <li>• organisational</li> <li>• timelines.</li> </ul>
<b>Different contributions</b> may relate to:	<ul style="list-style-type: none"> <li>• different approaches to expressing opinions or ideas</li> <li>• inclinations to lead or follow</li> <li>• influence with others</li> <li>• interpersonal skills</li> <li>• networks</li> <li>• past experience</li> <li>• technical skills and expertise.</li> </ul>
<b>Professional and practical project considerations</b> may include:	<ul style="list-style-type: none"> <li>• clarity around who does what</li> <li>• methods of payment</li> <li>• need for project planning</li> <li>• reporting requirements</li> <li>• resources: <ul style="list-style-type: none"> <li>• financial</li> <li>• human</li> <li>• physical.</li> </ul> </li> </ul>
<b>Review and evaluation</b> may include:	<ul style="list-style-type: none"> <li>• brainstorming</li> <li>• formal reporting</li> <li>• professional critique</li> <li>• reviewing feedback.</li> </ul>

## **Unit Sector(s)**

Industry capability – professional practice

## CUVPRP603A Engage in the business of creative practice

### Modification History

Version	Comments
CUVPRP603A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to adopt a professional approach to creative practice, including engaging in the business aspects of working as a creative practitioner.

### Application of the Unit

Independent creative practitioners sometimes work as employees in small and large organisations. Depending on the particular creative practice, they often operate as sole practitioners, in artist cooperatives, or as freelance or contract workers. Regardless of the business model, all practitioners earning income from their practice must engage with the professional business requirements for a sustainable creative practice.

This activity is self-directed.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

## Elements and Performance Criteria

1. Adopt professional work practices	<p>1.1 Develop a <b><i>professional work ethic</i></b> to support practice</p> <p>1.2 Collaborate and communicate with other professionals about the business aspects of creative practice</p> <p>1.3 Evaluate the <b><i>skills and knowledge</i></b> needed to operate as a successful creative practitioner</p> <p>1.4 Evaluate own current skills and abilities and the need for further <b><i>professional development</i></b></p> <p>1.5 Assess the potential for using <b><i>specialist expertise</i></b> to complement own skills</p> <p>1.6 Evaluate all aspects of own practice on an ongoing basis, as a key component of professional and personal growth</p>
2. Evaluate different business practices	<p>2.1 Investigate the different ways that creative practitioners do business</p> <p>2.2 Investigate the range of <b><i>business practices, systems and procedures</i></b> that need to be considered as part of professional creative practice</p> <p>2.3 Assess the relevance and implications of particular <b><i>business structures</i></b></p> <p>2.4 Consider the <b><i>physical resources</i></b> required by the practice and how they might be accessed</p> <p>2.5 Develop an overall approach to the business aspects of own practice based on evaluation of relevant information</p>
3. Address financial aspects of creative practice	<p>3.1 Investigate <b><i>financial considerations for creative practice</i></b></p> <p>3.2 Research and assess different ways of commercialising work and ideas</p> <p>3.3 Evaluate different <b><i>ways of costing and selling creative work</i></b></p>

	<p>3.4 Assess broader <i>financial management requirements</i> and their application to own practice</p> <p>3.5 Develop individual approaches to financial aspects of practice</p>
4. Analyse the rights and obligations of creative practitioners	<p>4.1 Evaluate the legal and moral <i>rights and obligations</i> of professional creative practice</p> <p>4.2 Practise work and business in ways that meet legal and moral obligations</p> <p>4.3 Pursue own rights as a creative practitioner consistent with own professional and ethical standards</p> <p>4.4 Establish and maintain sound approaches to safety and sustainability in professional practice</p>
5. Evaluate professional opportunities	<p>5.1 Evaluate work opportunities within and <i>beyond the creative sectors</i></p> <p>5.2 Be open to the potential for work opportunities in unexpected places, beyond established patterns of work</p> <p>5.3 Identify and access sources of professional advice</p> <p>5.4 Consider local and global opportunities for own practice</p> <p>5.5 Identify and evaluate opportunities offered by <i>current and emerging trends</i> in the consumption of culture and creative products</p> <p>5.6 Analyse the experiences of others as a way of discovering different opportunities</p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

Required skills
<ul style="list-style-type: none"> <li>communication skills to:             <ul style="list-style-type: none"> <li>collaborate with others on practice development issues</li> <li>interact with other creative and business professionals on management and development issues</li> </ul> </li> <li>critical thinking and analytical skills to:             <ul style="list-style-type: none"> <li>research and evaluate information and ideas from a wide range of sources</li> <li>reflect on complex issues and make judgements and decisions about those issues</li> </ul> </li> <li>initiative and enterprise skills to identify and pursue professional work opportunities</li> <li>learning and self-management skills to engage in and commit to an ongoing process of professional development and lifelong learning</li> <li>literacy skills to interpret varied information dealing with complex issues from a range of</li> </ul>

sources

- planning and organising skills to integrate a range of complex and varied information into a cohesive approach to development and management of own professional practice
- problem-solving skills to assess potentially competing and conflicting issues and develop solutions for own practice
- numeracy skills to manage the financial aspects of a professional practice
- technology skills to use the internet as a research tool
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### Required knowledge

- types of behaviour and practice that constitute a professional way of working in the specific area of creative practice
- professional development opportunities for the specific area of creative practice
- types and sources of external expertise and professional advice for creative practitioners that could be used in professional practice, including different industry organisations
- general business structures, practices, systems and procedures that apply to all professional practitioners, as well as typical ways that business is done in the specific area of creative practice
- physical resources needed for different types of professional practice and different ways they may be set up or accessed
- financial management practices that apply to all professional practitioners, including financial models and structures that apply to the specific area of creative practice
- factors to consider when costing and selling work and methods of selling work, including commissions
- range of professional practice skills needed by creative practitioners
- range of work opportunities open to the creative practitioner, both within and outside the creative sectors
- trends in the consumption of culture and creative products and their impact on professional creative practice
- legal rights and obligations of creative practitioners, particularly in relation to intellectual property, OHS and duty of care

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• research and evaluate a broad range of business information,</li> </ul>

<b>evidence required to demonstrate competency in this unit</b>	<p>including business structures, financial considerations, and legal rights and obligations</p> <ul style="list-style-type: none"> <li>• develop cohesive approaches and strategies for own practice that are grounded in research and reflection</li> <li>• articulate the range of professional opportunities for creative practice within and beyond the creative sectors</li> <li>• apply a highly developed understanding of the arts industry, including new and emerging trends in work practice.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>• industry networks and information</li> <li>• general business information.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of presentation or documentation prepared by the candidate detailing professional practice ideas and strategies</li> <li>• questioning and discussion about candidate's professional plans</li> <li>• participation in discussions with the candidate and others about professional practice in a given area</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Professional work ethic</i></b>	<ul style="list-style-type: none"> <li>• building sustainable professional relationships</li> <li>• commitment to ongoing learning and development</li> </ul>
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may refer to:	<ul style="list-style-type: none"> <li>• ethical behaviours</li> <li>• honouring professional commitments</li> <li>• maintaining work / life balance</li> <li>• meeting timelines.</li> </ul>
<b><i>Skills and knowledge</i></b> may be:	<ul style="list-style-type: none"> <li>• creative</li> <li>• financial</li> <li>• interpersonal</li> <li>• practical</li> <li>• promotional.</li> </ul>
<b><i>Professional development</i></b> may include:	<ul style="list-style-type: none"> <li>• attendance at events</li> <li>• further study</li> <li>• industry engagement</li> <li>• mentoring</li> <li>• professional memberships</li> <li>• research.</li> </ul>
<b><i>Specialist expertise</i></b> may be:	<ul style="list-style-type: none"> <li>• business</li> <li>• financial</li> <li>• legal</li> <li>• marketing.</li> </ul>
<b><i>Business practices, systems and procedures</i></b> may relate to:	<ul style="list-style-type: none"> <li>• communication</li> <li>• financial management</li> <li>• marketing</li> <li>• operations</li> <li>• safety</li> <li>• sales</li> <li>• technology.</li> </ul>
<b><i>Business structures</i></b> may include:	<ul style="list-style-type: none"> <li>• cooperatives</li> <li>• companies</li> <li>• partnerships</li> <li>• sole practitioner structures</li> <li>• trusts.</li> </ul>
<b><i>Physical resources</i></b> may include:	<ul style="list-style-type: none"> <li>• equipment</li> <li>• materials</li> <li>• tools</li> <li>• work space.</li> </ul>
<b><i>Financial considerations for creative practice</i></b> may relate to:	<ul style="list-style-type: none"> <li>• costs, including: <ul style="list-style-type: none"> <li>• commissions</li> <li>• consignment fees</li> <li>• exhibition fees</li> </ul> </li> <li>• distribution channels for work</li> <li>• income, such as:</li> </ul>



	<ul style="list-style-type: none"> <li>• awards</li> <li>• donations</li> <li>• government grants</li> <li>• residencies</li> <li>• sponsorships.</li> </ul>
<b><i>Ways of costing and selling creative work</i></b> may include:	<ul style="list-style-type: none"> <li>• consignment</li> <li>• quoting for materials</li> <li>• quoting for time</li> <li>• taking commissions</li> <li>• whole project quotations.</li> </ul>
<b><i>Financial management requirements</i></b> may relate to:	<ul style="list-style-type: none"> <li>• accounting systems and software</li> <li>• insurance</li> <li>• invoicing</li> <li>• paying accounts</li> <li>• record keeping</li> <li>• reporting requirements</li> <li>• taxation issues.</li> </ul>
<b><i>Rights and obligations</i></b> may relate to:	<ul style="list-style-type: none"> <li>• copyright and intellectual property</li> <li>• duty of care</li> <li>• moral rights</li> <li>• safety of self and others</li> <li>• taxation responsibilities.</li> </ul>
<b><i>Beyond the creative sectors</i></b> may refer to contexts such as:	<ul style="list-style-type: none"> <li>• business</li> <li>• community organisations</li> <li>• science</li> <li>• technology.</li> </ul>
<b><i>Current and emerging trends</i></b> may relate to:	<ul style="list-style-type: none"> <li>• changing social mores</li> <li>• economic climate</li> <li>• habits of different age groups or genders</li> <li>• impact of technology</li> <li>• lifestyle trends</li> <li>• political environment.</li> </ul>

## Unit Sector(s)

Industry capability – professional practice

## CUVPRP604A Publicly present a body of own creative work

### Modification History

Version	Comments
CUVPRP604A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to publicly present a body of professional creative work, from ideas generation, to the organisation process, through to the actual preparation of work for presentation. Evaluation is also a key focus of the unit.

### Application of the Unit

Professional creative practitioners in many sectors apply the skills and knowledge in this unit.

At this level, practitioners publicly present a coherent body of professional work and may be involved in organisation and promotional processes associated with the presentation.

The presentation may be a physical or virtual exhibition, but may also include presentations such as shows, competitions or performances.

This activity is self-directed.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

### Elements and Performance Criteria

1. Create or confirm public presentation opportunity	1.1 Identify and confirm the purpose, scope and objectives of the <b>public presentation</b> in consultation with <b>relevant people</b> 1.2 Determine <b>presentation requirements</b> from relevant information
2. Generate public presentation ideas	2.1 Evaluate the nature of the audience, its needs and expectations 2.2 Evaluate the <b>place of own work within the broader presentation context</b> 2.3 Develop broad parameters for own content based on overall objectives, audience needs and nature of own work 2.4 Consider <b>new and different ways of presenting work</b> 2.5 Select and develop appropriate themes based on own work practice and presentation requirements 2.6 Challenge and refine ideas through collaboration and discussion with others
3. Plan and organise public presentation	3.1 Establish <b>organisational roles and responsibilities</b> , including own role 3.2 Evaluate and organise <b>resources</b> required for realising the presentation 3.3 Evaluate <b>constraints and risks</b> , and take action to address them 3.4 Develop, implement and monitor an action plan for the organisation process based on specific requirements 3.5 Consult with relevant people during the organisation process
4. Participate in	4.1 Establish own role in promotion in consultation with relevant

promotion	people 4.2 Undertake <i>promotional activities</i> within scope of individual responsibility
5. Prepare work for public presentation	5.1 Evaluate the actions needed to prepare work for presentation 5.2 Prepare the body of creative work for inclusion in presentation 5.3 Where appropriate, develop <i>collateral material</i> to support the presentation
6. Evaluate public presentation	6.1 Review and reflect on the overall success of the presentation 6.2 Evaluate <i>implications for own creative work</i> based on audience response and own reflection 6.3 Build learnings from the presentation into future practice

## Required Skills and Knowledge

### Required skills

- communication skills to:
  - liaise with others on practical operational issues
  - share ideas about own work
- critical thinking and analytical skills to generate and refine ideas and themes
- initiative and enterprise skills to develop innovative approaches to presentation of own work
- learning and self-management skills to evaluate the presentation and integrate learning into future practice
- literacy skills to interpret a range of practical organisational documentation
- numeracy skills to estimate financial resources required for presentation
- planning and organising skills to coordinate the practical aspects of preparing work for public presentation
- problem-solving skills to evaluate constraints and risks and take action to address them

### Required knowledge

- key aspects of the presentation organisation process, including different roles and responsibilities
- basic presentation promotional activities
- current and emerging trends, ideas and theories for presentation of work in chosen area of practice
- intellectual property issues and legislation and how they relate to public presentations of creative work

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• prepare a coherent body of professional creative work for public presentation</li> <li>• participate professionally in the presentation planning, promotion and organisational process</li> <li>• evaluate presentation in terms of implications for future practice.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure:</p> <ul style="list-style-type: none"> <li>• access to a public presentation site (physical or virtual)</li> <li>• interaction with others as a part of the presentation planning and organisational process.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of a public presentation of the candidate's work</li> <li>• evaluation of reports prepared by the candidate detailing processes undertaken, challenges encountered and how they were addressed</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Public presentation</i></b> may be:	<ul style="list-style-type: none"> <li>• competition</li> <li>• exhibition (virtual or physical)</li> <li>• performance</li> <li>• show.</li> </ul>
<b><i>Relevant people</i></b> may include:	<ul style="list-style-type: none"> <li>• collaborators</li> <li>• marketing and promotional personnel</li> <li>• mentors</li> <li>• other exhibitors</li> <li>• venue managers.</li> </ul>
<b><i>Presentation requirements</i></b> may relate to:	<ul style="list-style-type: none"> <li>• information to be supplied</li> <li>• locations</li> <li>• packaging or presentation of work</li> <li>• style or theme of work</li> <li>• timelines.</li> </ul>
<b><i>Place of own work within the broader presentation context</i></b> may relate to:	<ul style="list-style-type: none"> <li>• cultural considerations</li> <li>• juxtaposition of exhibitors</li> <li>• number of exhibitors</li> <li>• overall objectives of exhibition</li> <li>• potential audience</li> <li>• potential benefits</li> <li>• potential risks</li> <li>• synergies between exhibitors</li> <li>• themes.</li> </ul>
<b><i>New and different ways of presenting work</i></b> may relate to:	<ul style="list-style-type: none"> <li>• challenging the audience</li> <li>• interpretation of work</li> <li>• involving the audience</li> <li>• physical presentation.</li> </ul>
<b><i>Organisational roles and responsibilities</i></b> may relate to:	<ul style="list-style-type: none"> <li>• catering responsibility</li> <li>• installation of work</li> <li>• marketing and promotion</li> <li>• project management</li> </ul>

	<ul style="list-style-type: none"> <li>venue management.</li> </ul>
<b>Resources</b> may be:	<ul style="list-style-type: none"> <li>financial</li> <li>human</li> <li>physical.</li> </ul>
<b>Constraints and risks</b> may relate to:	<ul style="list-style-type: none"> <li>availability of materials</li> <li>financial limitations</li> <li>physical venue constraints</li> <li>timelines.</li> </ul>
<b>Promotional activities</b> may include:	<ul style="list-style-type: none"> <li>developing background material</li> <li>developing interpretive material</li> <li>developing promotional material</li> <li>inviting people to view presentation</li> <li>providing lists of invitees to others</li> <li>placing information on social networking sites.</li> </ul>
<b>Collateral material</b> may include:	<ul style="list-style-type: none"> <li>catalogues</li> <li>interpretive material</li> <li>photographs</li> <li>work documentation.</li> </ul>
<b>Implications for own creative work</b> may include:	<ul style="list-style-type: none"> <li>commercial considerations</li> <li>confirmation of current approaches</li> <li>potential new directions for work</li> <li>need for further research</li> <li>need for further skill development.</li> </ul>

## Unit Sector(s)

Industry capability – professional practice

## CUVRES502A Analyse cultural history and theory

### Modification History

Version	Comments
CUVRES502A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to research, analyse and debate cultural history and theory, and to use those processes to develop individual approaches to creative work.

### Application of the Unit

People working across all cultural sectors enrich their professional practice through their understanding of cultural history and theory.

This unit may also apply to individuals working much more broadly in business and community roles.

History and theory may cover a particular period of time, a particular area of cultural practice, a particular social issue, or be broader in nature.

At this level, a person engages in a largely independent research process that begins to inform practice at a professional level. The research may be guided by others in terms of its scope and objectives.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

### Element

*Elements describe the essential outcomes of a unit of competency.*

### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Select a focus for cultural research	<p>1.1. Select a focus for research in consultation with others based on <b><i>individual needs and perspectives</i></b></p> <p>1.2. Make an initial determination of the information and ideas to be sought</p> <p>1.3. Challenge own <b><i>assumptions and preconceptions</i></b> about the research process and potential information sources</p> <p>1.4. Select relevant <b><i>historical and contemporary sources</i></b> for investigation</p>
2. Conduct critical analysis	<p>2.1. Seek out and compare the critical views of <b><i>others</i></b> in chosen area of inquiry</p> <p>2.2. Investigate issues around the historical and contemporary production, interpretation, promotion and consumption of culture</p> <p>2.3. Allow the process of analysis to take exploration of issues in <b><i>new and unintended directions</i></b></p>
3. Discuss cultural history and theory	<p>3.1. Develop <b><i>substantiated opinions and ideas</i></b> about cultural history and theory</p> <p>3.2. Make informed contributions to discussions of cultural history and theory</p> <p>3.3. Encourage and participate in open and constructive discussion</p>
4. Develop own practice from research	<p>4.1. Determine potential for <b><i>integration of research findings</i></b> into own work</p> <p>4.2. Relate cultural history and theory to <b><i>professional</i></b></p>

	<p><b><i>practice issues</i></b></p> <p>4.3. Recognise connections and associations between history and theory and contemporary cultural practice</p> <p>4.4. Develop ideas about how research might impact on or enrich own professional practice and its future direction</p>
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## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

### Required skills

- communication skills to participate in debate and discussion of cultural history and theory
- critical thinking skills to analyse information and develop substantiated positions about cultural history and theory
- initiative and enterprise skills to use, challenge and adapt research to develop own professional practice
- literacy skills to interpret varied information sources dealing with at times complex ideas
- learning and self-management skills to use the research process as a professional development tool
- planning and organising skills to set up and undertake a research process.

### Required knowledge

- ways of selecting a meaningful individual research focus
- opportunities offered by cultural history and theory in terms of value to a developing professional practice in the arts and in the broader community
- intellectual property issues and legislation and how they relate to the research process.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate</b>	<p>Evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• select an appropriate research focus</li> <li>• analyse cultural ideas and information and develop</li> </ul>

<b>competency in this unit</b>	<p>substantiated positions to support professional practice</p> <ul style="list-style-type: none"> <li>participate in informed discussion of cultural history and theory.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must ensure access to:</p> <ul style="list-style-type: none"> <li>a range of cultural history and theory information sources.</li> </ul>
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>evaluation of presentation or documentation prepared by the candidate explaining research processes and how issues surrounding history and theory have been incorporated into work</li> <li>evaluation of case studies to assess ability to research and use different types of information</li> <li>evaluation of the candidate's cultural literacy skills and ability to recognise, review and analyse different cultural productions, artworks, artistic values, artists, performers or authors</li> <li>questioning and discussion about candidate's intentions and the work outcome</li> <li>review of portfolios of evidence</li> <li>review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	<p>Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.</p>

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b><i>Individual needs and perspectives</i></b> may be influenced by:	<ul style="list-style-type: none"> <li>• art form focus</li> <li>• commercial aspirations or requirements</li> <li>• discussions and ideas of others</li> <li>• materials and processes</li> <li>• presence of a multidisciplinary focus</li> <li>• previous research</li> <li>• techniques used in own practice.</li> </ul>
<b><i>Assumptions and preconceptions</i></b> may relate to:	<ul style="list-style-type: none"> <li>• different cultural responses to research</li> <li>• how information is presented</li> <li>• level of formality required in the research process</li> <li>• own preconceptions</li> <li>• preconceptions of others</li> <li>• what types of research are acceptable</li> <li>• where to find information.</li> </ul>
<b><i>Historical and contemporary sources</i></b> may include:	<ul style="list-style-type: none"> <li>• artworks</li> <li>• commercial brief</li> <li>• critical writing</li> <li>• events</li> <li>• exhibitions</li> <li>• experiences of self or others</li> <li>• films</li> <li>• images</li> <li>• internet</li> <li>• music</li> <li>• objects</li> <li>• other people</li> <li>• performances</li> <li>• presentations</li> <li>• printed texts</li> <li>• technical information.</li> </ul>
<b><i>Others</i></b> may include:	<ul style="list-style-type: none"> <li>• arts critics</li> <li>• other artists</li> <li>• peers</li> <li>• teachers.</li> </ul>
<b><i>New and unintended directions</i></b> may be those which:	<ul style="list-style-type: none"> <li>• challenge preconceptions about work process and outcomes</li> <li>• generate completely new ideas</li> <li>• lead the individual to work in a different medium</li> <li>• take the individual back to earlier ideas.</li> </ul>
<b><i>Substantiated opinions</i></b>	<ul style="list-style-type: none"> <li>• grounded in appropriate research</li> </ul>

<i>and ideas</i> are:	<ul style="list-style-type: none"><li>• the result of rational and logical thought</li><li>• subjected to the analysis of others (e.g. peer review)</li><li>• supported by relevant information.</li></ul>
<i>Integration of research findings</i> may relate to:	<ul style="list-style-type: none"><li>• design strategies</li><li>• genres</li><li>• ideas and themes</li><li>• materials</li><li>• media</li><li>• motifs</li><li>• processes</li><li>• styles</li><li>• techniques</li><li>• technologies.</li></ul>
<i>Professional practice issues</i> may relate to:	<ul style="list-style-type: none"><li>• marketing and promotion of work</li><li>• need for collaboration</li><li>• need for further research and development time</li><li>• new opportunities.</li></ul>

## Unit Sector(s)

Knowledge management – research

## CUVRES601A Extend cultural research expertise

### Modification History

Version	Comments
CUVRES601A	This version first released with <i>CUV11 Visual Arts, Craft and Design Training Package version 1.0</i>

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to extend and refine individual cultural research capability, both in the context of own practice and as part of the broader cultural context.

### Application of the Unit

Independent professional practice in the creative industries involves the ability to research and engage with current cultural debate and with cultural history and theory.

At this level, the practitioner engages in a self-directed independent research process.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

#### Element

*Elements describe the essential outcomes of a unit of competency.*

#### Performance Criteria

*Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold*

*italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.*

## Elements and Performance Criteria

1. Situate own practice in the wider context	<p>1.1. Reflect on the nature of own practice and its relationship to the <b><i>broader contemporary cultural context</i></b></p> <p>1.2. Explore the relationship of individual practice to particular aspects of cultural history and theory</p> <p>1.3. Consider how own work connects to or diverges from the work of other professionals</p> <p>1.4. Analyse the ways in which individual practice has evolved, and the influences that have affected this evolution</p>
2. Extend research capability	<p>2.1. Investigate <b><i>ways to extend individual research</i></b> to support professional practice and self-development</p> <p>2.2. Develop potential areas of research based on current or planned developments in practice and broader areas of interest</p> <p>2.3. Conduct in-depth analysis of critical writing as part of an ongoing research practice</p>
3. Refine and articulate own positions and ideas	<p>3.1. Evolve personal ideas based on developing research activity and <b><i>critical analysis</i></b></p> <p>3.2. Participate in <b><i>current cultural debate</i></b> with peers and within the wider community</p> <p>3.3. Seek and apply critical feedback from others</p> <p>3.4. Develop <b><i>substantiated ideas</i></b> on cultural topics</p> <p>3.5. Develop and present information in formats that meet <b><i>professional and relevant academic standards and conventions</i></b></p>

## Required Skills and Knowledge

*This section describes the skills and knowledge required for this unit.*

## Required skills

- communication skills to:
  - articulate complex arguments
  - participate in debate and discussion of cultural history and theory
- analytical and literacy skills to:
  - examine the nature of own practice and its place in the wider context
  - analyse varied information sources dealing with complex ideas
- initiative and enterprise skills to seek proactive involvement in cultural debate
- planning and organising skills to set up and undertake a research process
- learning and self-management skills to extend individual research capability through self-directed projects
- technology skills to:
  - present information in appropriate formats
  - use the web as a research tool.

## Required knowledge

- potential research opportunities for individual cultural practice
- range of historical and contemporary critical writing relevant to individual research focus
- conventions for the presentation of information and ideas
- intellectual property issues and legislation and how they relate to the research process.

## Evidence Guide

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.*

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Evidence of the ability to: <ul style="list-style-type: none"> <li>• interrogate own practice to a depth that allows the candidate to make connections with the broader cultural context</li> <li>• develop a professional research capability in the area of cultural history and theory</li> <li>• articulate and present complex ideas following appropriate conventions.</li> </ul>
<b>Context of and specific resources for</b>	Assessment must ensure access to: <ul style="list-style-type: none"> <li>• a range of cultural history and theory information sources.</li> </ul>



<b>assessment</b>	
<b>Method of assessment</b>	<p>A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:</p> <ul style="list-style-type: none"> <li>• evaluation of research projects undertaken by the candidate</li> <li>• evaluation of the candidate's cultural literacy skills and ability to recognise, review and analyse different cultural productions, artworks, artistic values, artists, performers and authors</li> <li>• questioning and discussion about candidate's intentions and the work outcome</li> <li>• review of portfolios of evidence</li> <li>• review of third-party reports from experienced practitioners.</li> </ul> <p>Assessment methods should closely reflect workplace demands (e.g. literacy) and the needs of particular groups (e.g. people with disabilities, and people who may have literacy or numeracy difficulties, such as speakers of languages other than English, remote communities and those with interrupted schooling).</p>
<b>Guidance information for assessment</b>	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.*

<b>Broader contemporary cultural context</b> may be:	<ul style="list-style-type: none"> <li>• economic</li> <li>• environmental</li> <li>• geographic</li> <li>• heritage</li> <li>• historical</li> <li>• local, national and international</li> <li>• political</li> </ul>
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	<ul style="list-style-type: none"> <li>• philosophical</li> <li>• social and cultural</li> <li>• style or design related.</li> </ul>
<b><i>Ways to extend individual research</i></b> may involve:	<ul style="list-style-type: none"> <li>• community engagement</li> <li>• connecting to areas of research beyond the obvious</li> <li>• further study</li> <li>• greater levels of specialisation and depth in research</li> <li>• mentored reflection</li> <li>• self-analysis.</li> </ul>
<b><i>Critical analysis</i></b> may involve:	<ul style="list-style-type: none"> <li>• adapting</li> <li>• analysing and evaluating actions and policies</li> <li>• challenging</li> <li>• clarifying issues, values and standards</li> <li>• comparing similar situations</li> <li>• comparing and contrasting ideals with practice</li> <li>• comparing and evaluating beliefs, interpretations and theories</li> <li>• critical path process</li> <li>• debate and discussion</li> <li>• developing criteria for evaluation</li> <li>• distinguishing relevant from irrelevant facts</li> <li>• examining and evaluating assumptions</li> <li>• exploring implications and consequences</li> <li>• generating and assessing solutions</li> <li>• judging</li> <li>• leap of faith</li> <li>• making connections between seemingly unrelated information</li> <li>• making interdisciplinary connections</li> <li>• making plausible inferences and predictions</li> <li>• noting significant similarities and differences</li> <li>• openness</li> <li>• questioning</li> <li>• reading and listening critically</li> <li>• reflecting.</li> </ul>
<b><i>Current cultural debate</i></b> may relate to:	<ul style="list-style-type: none"> <li>• arts education</li> <li>• arts funding</li> <li>• artists' rights</li> <li>• emerging trends and practices</li> <li>• government policy</li> <li>• philosophical issues.</li> </ul>

<b><i>Substantiated ideas</i></b> are:	<ul style="list-style-type: none"><li>• grounded in appropriate research</li><li>• the result of rational and logical thought</li><li>• supported by relevant information</li><li>• subjected to the analysis of others (e.g. peer review).</li></ul>
<b><i>Professional and relevant academic standards and conventions</i></b> may relate to:	<ul style="list-style-type: none"><li>• copyright and intellectual property</li><li>• cultural considerations</li><li>• presentation of work</li><li>• referencing protocols</li><li>• report writing</li><li>• use of terminology.</li></ul>

## Unit Sector(s)

Knowledge management – research

## FDFOP2005A Work in a socially diverse environment

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the skills and knowledge required to work in a socially diverse environment, including the development and application of cultural awareness required to interact effectively with people from diverse backgrounds.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit is based on the tourism and hospitality unit THHCOR2A Work in a socially diverse environment and the transport and distribution unit TDTG701A Work in a socially diverse environment.</p> <p>This unit involves the application of communication principles and problem solving techniques to facilitate work in a socially diverse environment.</p>
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Communicate with people from diverse backgrounds	1.1. People from all cultural groups are valued and treated with respect and sensitivity 1.2. Verbal and non-verbal communication takes account of cultural differences 1.3. Where language barriers exist, efforts are made to communicate through use of gestures or simple words in the other persons' language 1.4. Assistance from colleagues, specialist resources or outside organisations is obtained when required
2. Respond to cross-cultural misunderstandings	2.1. Issues which may cause conflict or misunderstanding in the workplace are identified 2.2. Difficulties are addressed with the appropriate people in the workplace 2.3. When difficulties or misunderstandings occur, possible cultural differences are considered 2.4. Efforts are made to resolve the misunderstanding, taking account of cultural considerations 2.5. Issues and problems that cannot be resolved are referred as required for follow up

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

##### *Ability to:*

- identify and recognise cultural differences in the workplace
- apply understanding of cultural difference to communicate effectively to achieve work requirements, including selecting appropriate communication style to suit audience
- identify and respond to cross-cultural misunderstandings
- use oral communication skills/language competence to fulfil the job role as specified by the organisation, including questioning, active listening, asking for clarification and seeking advice from supervisor

#### Required knowledge

##### *Knowledge of:*

- principles of equal employment opportunity (EEO) and anti-discrimination legislation as they apply to company and employee rights and responsibilities in the workplace
- recognition of the different cultural groups in the workplace
- understanding of the basis of cultural difference, including behaviour or practices that can cause offence, and related strategies for interacting in ways that are culturally sensitive
- communication strategies and styles appropriate to diverse audiences related to the workplace

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

Assessment must be carried out in a manner that recognises the cultural and literacy requirements of the assessee and is appropriate to the work performed. Competence in this unit must be achieved in accordance with food safety standards and regulations.

<b>EVIDENCE GUIDE</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Evidence of ability to:</p> <ul style="list-style-type: none"> <li>• identify responsibilities according to the principles of anti-discrimination legislation</li> <li>• treat people from other cultures with respect and sensitivity</li> <li>• make efforts to communicate and understand others using verbal and non-verbal techniques</li> <li>• seek assistance when required to facilitate understanding</li> <li>• treat cross-cultural misunderstandings with sensitivity and act to resolve the matter with respect.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment must occur in a real or simulated workplace where the assessee has access to:</p> <ul style="list-style-type: none"> <li>• advice on legal rights and responsibilities relating to anti-discrimination and EEO</li> <li>• related company policies and procedures</li> <li>• opportunities to interact with others using typical workplace communication processes.</li> </ul>
<b>Method of assessment</b>	<p>This unit should be assessed together with core units and other units of competency relevant to the function or work role.</p>
<b>Guidance information for assessment</b>	<p>To ensure consistency in one's performance, competency should be demonstrated on more than one occasion over a period of time in order to cover a variety of circumstances, cases and responsibilities, and where possible, over a number of assessment activities.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Policies and procedures</b>	Work is carried out according to company policies

<b>RANGE STATEMENT</b>	
	and procedures, regulatory and licensing requirements, legislative requirements and industrial awards and agreements
<b>Legislative requirements</b>	<p>Legislative requirements are typically reflected in procedures and specifications. Legislation includes:</p> <ul style="list-style-type: none"> <li>• anti-discrimination</li> <li>• EEO</li> </ul>
<b>People from diverse backgrounds</b>	<p>People from diverse backgrounds may include:</p> <ul style="list-style-type: none"> <li>• any person involved in or related to the work process, such as work colleagues, managers and external personnel</li> </ul>
<b>Cultural differences</b>	<p>Cultural difference may include but is not limited to:</p> <ul style="list-style-type: none"> <li>• race</li> <li>• special needs</li> <li>• disabilities</li> <li>• gender</li> <li>• marital status</li> <li>• sexual preference</li> <li>• age</li> </ul>
<b>Examples of cultural differences</b>	<p>Examples of cultural differences may include but are not limited to:</p> <ul style="list-style-type: none"> <li>• language spoken and related communication style</li> <li>• levels of formality/informality</li> <li>• personal grooming</li> <li>• family obligations</li> <li>• recognised holidays</li> <li>• customs</li> <li>• work ethic</li> <li>• product preferences</li> </ul>
<b>Outside organisations</b>	<p>Outside organisations may include but are not limited to:</p> <ul style="list-style-type: none"> <li>• interpretative services</li> <li>• diplomatic services</li> <li>• local cultural organisations</li> <li>• appropriate government agencies</li> </ul>



**RANGE STATEMENT**

- |  |  |
|--|--|
|  | <ul style="list-style-type: none"><li>• educational institutions</li></ul> |
|--|--|

**Unit Sector(s)**

<b>Unit sector</b>	Operational
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

Co-requisite units	

## ICTTC136B Install, maintain and modify customer premises communications cabling: ACA Restricted Rule

### Modification History

Not applicable.

### Unit Descriptor

This unit defines the level of competence that is required for the purpose of the Australian Communications Authority's **"Restricted"** Cabling Provider Rule. Restricted cabling is used in typical domestic premises small office home offices and small business premises situations. Restricted cablers can install cable in large commercial and industrial premises as long as the cabling is behind a compliant device and cabling is not via jumperable distributors or patch panels.

This unit applies to customer cabling terminated on sockets and network termination devices (NTD). It applies to the installation, maintenance and modification of indoor and external cabling at the levels stated in the range of variables.

Customer cabling, for the purpose of this standard, may be used to connect devices for a range of applications including: telecommunications (phones, facsimile and answering machines), simple data and computer use, security alarm panels, and fire control panels.

**Assessment by a TITAB registered assessor is recommended.**

**Prerequisite Units:** Nil

**Equivalent Units:** Nil

This unit defines the level of competence that is required for the purpose of the Australian Communications Authority's **"Restricted"** Cabling Provider Rule. Restricted cabling is used in typical domestic premises small office home offices and small business premises situations. Restricted cablers can install cable in large commercial and industrial premises as long as the cabling is behind a compliant device and cabling is not via jumperable distributors or patch panels.

This unit applies to customer cabling terminated on sockets and network termination devices (NTD). It applies to the installation, maintenance and modification of indoor and external cabling at the levels stated in the range of variables.

Customer cabling, for the purpose of this standard, may be used to connect devices for a range of applications including: telecommunications (phones, facsimile and answering machines), simple data and computer use, security alarm panels, and fire control panels.

**Assessment by a TITAB registered assessor is recommended.**

**Prerequisite Units:** Nil

**Equivalent Units:** Nil

## Application of the Unit

Not applicable.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Work within the constraints imposed by commercial premises	<ul style="list-style-type: none"><li>1.1 Identify building infrastructure which places critical constraints on cabling</li><li>1.2 Develop strategies to manage other infrastructure in relation to cabling</li></ul>
2 Manage Remote Power Feed	<ul style="list-style-type: none"><li>2.1 Identify the risks posed by contact with Remote Power Feeding services</li><li>2.2 Identify Remote Power Feeding services in a range of commonly encountered circumstances inside customer premises.</li></ul>
3 Install/alter cables and protective earth wires	<ul style="list-style-type: none"><li>3.1 Cables/wires handled in accordance with manufacturer's application specifications including tension and bending stress requirements</li><li>3.2 Sources of possible damage to cable/wires are identified and avoided including hot pipes, sharp edges and cable burn</li></ul>

- 3.3 Sufficient excess is allowed at cable ends to facilitate termination
  - 3.4 Cable is placed and secured to maintain safety and interference segregation in accordance with legislative and industry standards
  - 3.5 Cable ties not tightened to the point of causing cable sheath damage or transmission impairment and trimmed flush to prevent risk of personal damage
  - 3.6 Cables installed underground shall meet minimum depth of cover and segregation from hazardous electrical and other services as per AS/ACIF009
  - 3.7 Aerial cables installed shall meet minimum clearance, segregation from hazardous electrical and other services and minimum height requirements as per AS/ACIF009
  - 3.8 In accordance with AS/ACIF009, overvoltage protection devices are fitted to all cable pairs where required to suppress voltage surges and protect from EPR hazards and the devices protectively earthed
  - 3.9 Earth wire insulation is protected against damage and protective earths segregated in accordance with relevant industry and legislative standards
- 4 Terminate and test cables and earth wires
- 4.1 Cable sheath removed to allow for correct termination length and without damage to underlying conductors and their insulation
  - 4.2 NTD terminating modules are installed in accordance to manufacturer's specifications and cable pairs neatly and sequentially fanned for termination
  - 4.3 Conductors are terminated in accordance with recommended colour code sequence using appropriate termination tools in the manufacturer's specified manner
  - 4.4 Cable shield (if applicable) is earthed to manufacturer's specifications and relevant industry codes of practice and AS/ACIF009

- 4.5 Visual inspection is undertaken to confirm termination colour code sequence has been followed prior to end to end testing of wire and pair termination integrity
- 4.6 Earth wires are terminated with connectors recommended by manufacturers in accordance with accepted industry codes of practice and AS/ACIF009
- 4.7 Earth wire continuity is maintained through out and interface requirements with electrical systems are observed
- 4.8 Earthing installation shall be tested for continuity, insulation resistance and conductive resistance as per accepted industry standards including AS/ACIF009
- 4.9 Compatibility of alterations with existing systems is confirmed and new work tested both in isolation and when integrated with existing systems
- 5 Inspect cable route to ensure correct separations
  - 5.1 Check separations along the entirety of the cable route
  - 5.2 Rectify separations which do not comply with regulations
  - 5.3 Install barriers to achieve separations where spatial separation can't be met
- 6 Create records
  - 6.1 Complete TCA1 form and create NTD records
- 7 Monitor work activity
  - 7.1 Supervision of cablers not holding appropriate registration for the task is maintained to ensure installation/maintenance activity is in accordance with legislative requirements for safety and network integrity including AS/ACIF008 and AS/ACIF009

## Required Skills and Knowledge

Not applicable.

## **Evidence Guide**

### **Assessment location and resources**

Either

A workplace conducting the operations covered by this competency unit, equipment and resources relevant to the context of the work (See Range Statement) and support from a competent supervisor or mentor.

Or

A simulated environment with similar provisions which conforms to the Assessment Guidelines.

### **Critical evidence**

Assessment candidates should produce evidence of the following:

Demonstration of a cabling installation including 3 types of telephone sockets, one network termination device (NTD) and one alarm panel including TCA1 compliance form.

Accurate application of cable conductor identification codes.

Conduct and interpret cable test results.

Correct interpretation and application of standards and regulations.

### **Skills and knowledge**

Codes refer to the Skill and Knowledge Register included in this training package:

CA2200 Cable Installation

OH2200 Occupational Health and Safety

RE210 ACA Provider Rules, Cabler Registration, Rules and Regulations

TE2210 Basic Telephony

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Either

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CA2200 Cable Installation

OH2200 Occupational Health and Safety

RE210 ACA Provider Rules, Cabler Registration, Rules and Regulations

TE2210 Basic Telephony

## **Range Statement**

The following statements cover a wide range of circumstances. Assessment of candidates should be within the range that applies to the candidate's particular role or workplace.

This unit is generally applied to the ACA Restricted Cabling Rule coverage which is used in typical domestic premises but is also found in some small office home office and small business premises situations.

### **Building infrastructure**

Includes but not limited to:

high voltage power

other services

availability and suitability of existing cabling trays and fixing systems.

### **Strategies to manage infrastructure include:**

appropriate separations

fastening techniques

correct use of cable trays and support systems.

### **Remote power feed**

Applies to telecommunications services which operate at above TNV (Telecommunications Network Voltage).

### **Regulatory environment**

Overview **Telecommunications Act 1997**, ACA, ACIF, Labelling, Certified Components List (CCL) accredited registrars and registration.

### **Cabling environment**

Indoor environments include concealed locations such as:

ceilings

false ceilings

internal wall space

under floor

damp situations, and

within modular workstations.

Outdoor environments include cable installations on external walls and underground and/or aerial cabling on private property. Underground cabling would be in an exclusive trench or shared trench with electrical LV cables and/or other utilities. Aerial telecommunications cabling shall not include installations on poles shared with LV/HV electrical power cables/terminations.

### **Cable type**

Copper twisted pair including:

indoor

external

aerial, and

underground.

### **Cable identification**

Cable conductor identification codes may be:

colour coded

banded

numbered

lettered.

### **Termination systems:**

A range of at least 3 different socket types (Australian and US modular sockets and Mode 3 alarm sockets) and at least one network terminating device (NTD) must be individually terminated.

Note: Jumperable distributors not included in this unit requirement.

### **Earthing and protection**

Earthing for protection and surge suppression and must be treated in accordance with AS/ACIF009.

### **Separations**

The distance between communications cable and other services. This includes:

Low Voltage (LV)

High Voltage (HV) - Single core and HV Multi-core

Open terminations.

### **Regulations**

Regulations cover separations will generally be covered by Wiring Rules standard AS/ACIF009.

### **Spatial separations**



The distance between communications cable and other required by regulations where no barrier is installed.

### **Barriers**

Physical barriers installed when there is not enough space to achieve spatial separations.

### **Records**

TCA1 form (and future NTD record cards) must conform with AS/ACIF009.

**Relevant legislation, codes, regulations and standards (or their replacements) include relevant components of:**

ACA Technical Standards

AS/ACIF008, AS/ACIF009 - or subsequent replacements

SAA Communications Cabling Manual (Restricted)

AS/NZS 3000

The following statements cover a wide range of circumstances. Assessment of candidates should be within the range that applies to the candidate's particular role or workplace.

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### **Building infrastructure**

Includes but not limited to:

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other services

availability and suitability of existing cabling trays and fixing systems.

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within modular workstations.

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### **Separations**

The distance between communications cable and other services. This includes:

Low Voltage (LV)

High Voltage (HV) - Single core and HV Multi-core

Open terminations.

### **Regulations**

Regulations cover separations will generally be covered by Wiring Rules standard AS/ACIF009.

### **Spatial separations**

The distance between communications cable and other required by regulations where no barrier is installed.

### **Barriers**

Physical barriers installed when there is not enough space to achieve spatial separations.

### **Records**

TCA1 form (and future NTD record cards) must conform with AS/ACIF009.

**Relevant legislation, codes, regulations and standards (or their replacements) include relevant components of:**

ACA Technical Standards

AS/ACIF008, AS/ACIF009 - or subsequent replacements

SAA Communications Cabling Manual (Restricted)

AS/NZS 3000

### **Unit Sector(s)**

Not applicable.

## ICTTC137B Install, maintain and modify customer premises communications cabling: ACA Open Rule

### Modification History

Not applicable.

### Unit Descriptor

This unit defines the level of competence\* that is required for the purpose of the Australian Communications Authority's "**Open**" Cabling Provider Rule. This rule is associated with small installations connected to sockets and larger commercial and industry installations involving many lines, multi-pair cables, backbone cabling, multi-story buildings and more complicated termination modules and distributors.

This unit applies to customer cabling terminated on distributors. It applies to the installation, maintenance and modification of indoor, external, underground cabling at the levels stated in the range of variables.

Customer cabling, for the purpose of this standard, may be used to connect devices for a range of applications, including for example: telecommunications (phones and facsimile), data including video and multimedia, security and alarms, and fire protection.

This unit meets the minimum ACA "prescribed level of knowledge and skill that safeguards matters of health, safety, network integrity and addresses matters of interoperability where customer equipment and standard telephone service are involved" only.

**Note: This does not imply industry competency using specialised cabling such as: Co-axial, Optical Fibre and Structured cabling.**

**Prerequisite Unit:** ICTTC136B Install, maintain and modify customer premises communications cabling: ACA Restricted Rule.

**Equivalent Unit/s: Note:** Completion of the following 6 cabling units: ICTTC005B, ICTTC006B, ICTTC008B, ICTTC012B, ICTTC017B and ICTTC022B exceeds the requirements of this standard and fulfils the requirements for ACA Cabling Provider Rules: Open Cabling Category for Cabler Registration.

This unit defines the level of competence\* that is required for the purpose of the Australian Communications Authority's "**Open**" Cabling Provider Rule. This rule is associated with small installations connected to sockets and larger commercial and industry installations involving many lines, multi-pair cables, backbone cabling, multi-story buildings and more complicated termination modules and distributors.

This unit applies to customer cabling terminated on distributors. It applies to the installation, maintenance and modification of indoor, external, underground cabling at the levels stated in the range of variables.

Customer cabling, for the purpose of this standard, may be used to connect devices for a range of applications, including for example: telecommunications (phones and facsimile), data including video and multimedia, security and alarms, and fire protection.

This unit meets the minimum ACA "prescribed level of knowledge and skill that safeguards matters of health, safety, network integrity and addresses matters of interoperability where customer equipment and standard telephone service are involved" only.

**Note: This does not imply industry competency using specialised cabling such as: Co-axial, Optical Fibre and Structured cabling.**

**Prerequisite Unit:** ICTTC136B Install, maintain and modify customer premises communications cabling: ACA Restricted Rule.

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## Application of the Unit

Not applicable.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Work within the constraints imposed by commercial premises	1.1 Identify building infrastructure which places critical constraints on cabling 1.2 Develop strategies to manage other infrastructure in relation to cabling

- |   |   |   |
|---|---|---|
| 2 | Manage Remote Power Feed  | 2.1 Identify the risks posed by contact with Remote Power Feeding services  |
|   |   | 2.2 Identify Remote Power Feeding services in a range of commonly encountered circumstances inside customer premises.   |
| 3 | Install/modify cable support, earthing and termination infrastructure | 3.1 Ensure site is free of telecommunication hazards  |
|   |   | 3.2 Fixings and cable support structures of adequate strength are installed safely, aligned with the environment and in accordance with manufacturer's and customer's specifications  |
|   |   | 3.3 Catenary supports are secured to building structure and tensioned where necessary to ensure cable weight can be carried in operating conditions with interference and safety segregation maintained including adherence to AS/ACIF009 |
|   |   | 3.4 Protective earthing of metal work is installed to industry standards where required   |
|   |   | 3.5 Installed support structure is checked to ensure cable will not be exposed to damage during installation and general operation  |
|   |   | 3.6 Terminating equipment positioning and fixing follows accepted industry codes of practice, standards and customer requirements   |
|   |   | 3.7 Back-mount and outlet layout conforms to manufacturer's specifications and allows adequate work space for ease of access and avoid overlaying   |
|   |   | 3.8 Incoming and outgoing cables are segregated to ensure ease of access and avoid overlaying   |
| 4 | Install/alter cables and earth wires                                  | 4.1 Cables/wires handled in accordance with manufacturer's application specifications including tension and bending stress requirements   |
|   |   | 4.2 Sources of possible damage to cable/wires are identified and avoided including hot pipes, sharp edges and cable burn  |
|   |   | 4.3 Sufficient excess is allowed at cable ends to facilitate termination  |

- 4.4 Telecommunication outlet ends of cable is uniquely labelled to match identifier at originating location
  - 4.5 Cable is placed and secured to maintain safety and interference segregation in accordance with legislative and industry standards
  - 4.6 Cable ties not tightened to the point of causing cable sheath damage or transmission impairment and trimmed flush to prevent risk of personal damage
  - 4.7 Cables installed as catenaries or supported by catenaries in external environment shall meet minimum above ground clearances and clearances from hazardous electrical services as per AS/ACIF009
  - 4.8 Cables installed underground shall meet minimum depth of cover and segregation from hazardous electrical and other services as per AS/ACIF009
  - 4.9 In accordance with AS/ACIF009, over-voltage protection devices are fitted to all cable pairs, where required, to suppress voltage surges with the devices protectively earthed
  - 4.1 TRC/CES/Earth wire insulation is protected against damage and TRC/CES and protective earths segregated in accordance with relevant industry and legislative standards TS 009
- 5 Terminate and test cables and earth wires
- 5.1 Cable sheath removed to allow for correct termination length and without damage to underlying conductors and their insulation
  - 5.2 Terminating modules are installed in accordance to manufacturer's specifications and cable pairs neatly and sequentially fanned for termination
  - 5.3 Conductors are terminated in accordance with recommended colour code sequence using appropriate termination tools in the manufacturer's specified manner
  - 5.4 Cable shield (if applicable) is earthed to manufacturer's specifications and relevant industry codes of practice including AS/ACIF009

- 5.5 Visual inspection is undertaken to confirm termination colour code sequence has been followed prior to end to end testing of wire and pair termination integrity
  - 5.6 TRC/CES /Earth wires are terminated with connectors recommended by manufacturers in accordance with relevant industry codes of practice including AS/ACIF009
  - 5.7 TRC/CES /Earth wire continuity is maintained through out and interface requirements with electrical systems are observed
  - 5.8 TRC/CES /Earthing installation shall be tested for continuity, insulation resistance and conductive resistance as per relevant industry standards including AS/ACIF009
  - 5.9 Compatibility of alterations with existing systems is confirmed and new work tested both in isolation and when integrated with existing systems
- 6 Inspect cable route to ensure correct separations
  - 6.1 Check separations along the entirety of the cable route
  - 6.2 Rectify separations which do not comply with regulations
  - 6.3 Install barriers to achieve separations where spatial separation can't be met
- 7 Evaluate earthing needs for cable systems on customer premises
  - 7.1 Identify the role of functional, protective and CES earthing systems in customer premises
  - 7.2 Recognise existing earthing systems in customer premises
  - 7.3 Analyse the earthing needs of cable systems in a range of building types
  - 7.4 Identify cable characteristics relevant to the calculation of earthing requirements
  - 7.5 Calculate the upper and lower limits of resistance for a variety of cable system earths
- 8 Label earthing systems
  - 8.1 Identify label requirements for all types of earthing systems



- |    |                                       |  |  |
|----|---------------------------------------|--|--|
|    | 8.2                                   | Label earthing systems in accordance with industry regulations |  |
| 9  | Create/update cable plans and records | 9.1  | Record sheets and plans of cable location, type and infrastructure are accurately created or updated and stored in accordance with customer requirements   |
|    |                                       | 9.2  | Cable pairs are clearly labelled to provide an accurate identification in accordance with manufacturer's, industry and client standards  |
|    |                                       | 9.3  | Cable pair record books are created or updated to provide an accurate record of pair locations, inter-connections and usage in accordance with industry codes of practice and AS/ACIF009   |
|    |                                       | 9.4  | Complete Cabling Completion Advice/TCA1 form   |
| 10 | Monitor work activity                 | 10.  | Close supervision of cablers not holding appropriate registration for the task is maintained to ensure installation/maintenance activity is strictly in accordance with legislative requirements and industry standards for safety and network integrity including AS/ACIF008 and AS/ACIF009 |

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

### Assessment location and resources

Either

A workplace conducting the operations covered by this competency unit, equipment and resources relevant to the context of the work (See Range Statement) and support from a competent supervisor or mentor.

Or

A simulated environment with similar provisions which conforms to the Assessment Guidelines.

### Critical evidence

Assessment candidates should produce evidence of the following:

Demonstration of termination systems at both distributor and outlet locations and at least one 50 pair copper cable, including accurate completion of installation records, drawing alterations and compliance forms.

Placement of cables on support structures and building faces for both internal and external locations.

Securing methods for above locations.

Work practices which avoid cable damage such as crushing, burning, kinking, sheath twist, cutting and nicking, bending radius.

Ability to read and interpret drawings related to cable layouts, outlet location, cable coding system and identifiers, distributor locations.

Conduct and interpret cable test results.

Correct interpretation and application of standards and regulations.

### **Skills and knowledge**

Codes refer to the Skill and Knowledge Register included in this training package:

CA200 Cable Installation: Open

CA201 Cable Termination Products

CA202 Cable Conductor Identification Codes

CA210 Cable Support Systems

CA220 Cable Types

PS212 Read Plans and Specifications: General

PS213 Cable Record Systems: General

RE210 ACA Cabling Provider Rules, Cabler Registration, Rules and Regulations

SW210 Basic Switching Systems

TE210 Basic Telephony

Topics not covered in Skill and Knowledge Register:

Telecommunication hazard awareness

### **Assessment location and resources**

Either

A workplace conducting the operations covered by this competency unit, equipment and resources relevant to the context of the work (See Range Statement) and support from a competent supervisor or mentor.

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A simulated environment with similar provisions which conforms to the Assessment Guidelines.

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CA210 Cable Support Systems

CA220 Cable Types

PS212 Read Plans and Specifications: General

PS213 Cable Record Systems: General

RE210 ACA Cabling Provider Rules, Cabler Registration, Rules and Regulations

SW210 Basic Switching Systems

TE210 Basic Telephony

Topics not covered in Skill and Knowledge Register:

Telecommunication hazard awareness

## **Range Statement**

The following statements cover a wide range of circumstances. Assessment of candidates should be within the range that applies to the candidate's particular role or workplace.

This unit applies to the ACA Open Cabling Rule coverage for communications cabling installations applications to include larger commercial and industry installations involving many lines, multi-pair cables, backbone cabling, multi-story buildings and more complicated termination modules and distributors.

### **Building infrastructure**

Includes but not limited to:

high voltage power

other services

availability and suitability of existing cabling trays and fixing systems.

**Strategies to manage infrastructure include:**

appropriate separations

fastening techniques

correct use of cable trays and support systems.

**Remote power feed**

Applies to telecommunications services which operate at above TNV (Telecommunications Network Voltage).

**Regulatory environment**

Overview **Telecommunications Act 1997**, ACA, ACIF, Labelling, Certified Components List (CCL) accredited registrars and registration.

**Cabling environment**

Indoor environments include locations such as:

ceilings

false ceilings

riser shafts

internal wall space

under floor

damp situations, and

within workstations.

Outdoor environments include:

cable installations on external walls and underground, and/or

aerial cabling on private and public property.

Underground cabling including shared trenches with electrical LV cables and/or other utilities. Aerial cabling installations which may include the sharing of poles with LV/HV electrical power cables/terminations.

**Cable support systems include:**

suspension catenary wire

ducts

cable tray

line poles

pipes

pits

wall and island mounted patched and jumperable distributors including CDs, BDs, FDs, LDs.

Note: Cable trays may be galvanised steel or PVC: perforated low or high sided, single or multi channel. Cable ducts may be closed, open, PVC, metal, single or multiple channel.

### **Cable types**

Copper twisted pair from 2 pair upwards but must include 2, 3 and 4 pair and at least one larger cable (20 pair or greater).

Note: Cable and topology may be chosen to suit a range of applications including analogue voice (3.4 kHz bandwidth), digital voice (64 kB/s) and digital (2 MB/s ISDN).

### **Cable identification**

Cable conductor identification codes may be:

colour coded

banded

numbered

lettered.

### **Cable termination systems**

Termination of at least one jumperable distributor (CD/BD) with a capacity of 100 pairs or greater. Termination of a non-jumperable distributor (LD). Termination of a patch panel.

### **Earthing and protection systems**

Installation of protective earth(s) for over voltage and surge/spike suppression.

Installation of protective earth barriers for segregation, cable tray, duct and metal equipment enclosures.

Running of equi-potential bonding conductors to MEN (Multiple Earth Neutral) and use of earth stakes.

Installation of functional earth(s) including TRC and CES types to provide customer switching system facilities.

Earthing of screened cable, barriers and cable trays for the reduction/elimination of interference from electromagnetic, radio frequency and power sources.

### **Records include:**

Cabling Completion Advice/TCA1 (sign off form).

Building, cabling and equipment location plans.

BD/CD and FD record books, LD record cards.

Labelling of patch panels, distributor verticals, distributor pairs, equipment closets and rooms.

Labelling of telecommunication outlets.

And in the future possibly NTD record cards.

Note: Record books and cards may be hard copy or software versions but must conform with AS/ACIF009.

## **Functional, protective and CES earthing**

The three common types of earthing system used in customer premises for cabling systems. Cablers must understand the features and application of each type.

## **Cable characteristics**

This includes the electrical performance of the cable and its physical characteristics. Cabers must be able to identify the critical characteristics for each type of cable they use.

## **Label requirements**

Industry regulations define the labelling requirements in detail. Cablers must meet these requirements whenever installing earthing.

## **Clearances and segregation:**

Clearances and segregation requirements is defined in AS/ACIF009 (or its replacement).

## **Separations**

The distance between communications cable and other services. This includes:

Low Voltage (LV)

High Voltage (HV) - Single core and HV Multi-core

Open terminations.

## **Spatial separations**

The distance between communications cable and other required by regulations where no barrier is installed.

## **Barriers**

Physical barriers installed when there is not enough space to achieve spatial separations.

## **Relevant legislation, codes, regulations and standards (or their replacements) include relevant components of:**

ACA Technical Standards

AS/ACIF008, AS/ACIF009

SAA Communications Cabling Manual (Open)

AS/NZS 3000

Building Codes

The following statements cover a wide range of circumstances. Assessment of candidates should be within the range that applies to the candidate's particular role or workplace.

This unit applies to the ACA Open Cabling Rule coverage for communications cabling installations applications to include larger commercial and industry installations involving many lines, multi-pair cables, backbone cabling, multi-story buildings and more complicated termination modules and distributors.

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Includes but not limited to:

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other services

availability and suitability of existing cabling trays and fixing systems.

**Strategies to manage infrastructure include:**

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Indoor environments include locations such as:

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Cabling Completion Advice/TCA1 (sign off form).

Building, cabling and equipment location plans.

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Labelling of patch panels, distributor verticals, distributor pairs, equipment closets and rooms.

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## **Barriers**

Physical barriers installed when there is not enough space to achieve spatial separations.

## **Relevant legislation, codes, regulations and standards (or their replacements) include relevant components of:**

ACA Technical Standards

AS/ACIF008, AS/ACIF009

SAA Communications Cabling Manual (Open)

AS/NZS 3000

Building Codes

## **Unit Sector(s)**

Not applicable.

## LMFFDT4012A Produce ideation drawings

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit specifies the outcomes required to produce ideation drawings from a concept and design brief, to capture the spirit of a product visually, using integral design elements and principles.
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### Application of the Unit

<b>Application of the unit</b>	This unit supports the attainment of skills and knowledge required for competent workplace performance in furnishing operations of all sizes. Production of ideation drawings applies to an industry workplace or design studio environment and involves application of skills and knowledge at a supervisory equivalent level. These skills and knowledge are to be used within the scope of the individual's job and authority.
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan for production of ideation drawings	<p>1.1.Applicable <b><i>OHS, legislative and organisational requirements</i></b> relevant to producing ideation drawings are verified and complied with</p> <p>1.2.<b><i>Design brief</i></b> is reviewed, confirmed and clarified with <b><i>appropriate personnel</i></b></p> <p>1.3.Type and quantity of <b><i>ideation drawings</i></b> to be produced are assessed from the design brief</p> <p>1.4.<b><i>Drawing equipment</i></b> is selected appropriate to work requirements and checked for operational effectiveness in accordance with manufacturers recommendation</p> <p>1.5.<b><i>Communication</i></b> with others is established and maintained in accordance with OHS requirements</p>
2. Produce ideation drawings	<p>2.1.Multiple <b><i>concept</i></b> drawings are produced in keeping with the design brief</p> <p>2.2.Images are represented as <b><i>thumbnails</i></b> exploring design ideas and to provide a sense of feeling for the product and materials used</p> <p>2.3.Human figures are included in the drawings to provide a sense of balance</p> <p>2.4.Scale ideation drawings are produced to roughly represent the detail of joints, sections or product details</p> <p>2.5.<b><i>Specifications</i></b> are added to the ideation drawings as</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>reference points for <i>working drawings</i></p> <p>2.6.Ideation drawings are assessed for their <i>elements of design</i></p> <p>2.7.Ideation drawings are assessed for their <i>principles of design</i></p> <p>2.8.Ideation drawings are modified according to the design assessment and design brief requirements</p> <p>2.9.Ideation drawing faults are <i>recorded and reported</i> to the appropriate personnel</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- draw designs
- make presentations
- source information
- collect, organise and understand information related to design requirements
- maintain accurate records
- communicate ideas and information
- sequence operations
- carry out work according to ohs practices
- maintain current knowledge of interior decoration and design techniques.

#### Required knowledge

- State or Territory OHS legislation, regulations, standards and codes of practice relevant to the full range of processes for producing ideation drawings
- organisational and site standards, requirements, policies and procedures for producing ideation drawings
- environmental protection requirements
- established communication channels and protocols
- problem identification and resolution
- elements and principles of design
- ergonomics and aesthetic values
- types of tools and equipment and procedures for their safe use, operation and maintenance
- characteristics of materials, products and defects

**REQUIRED SKILLS AND KNOWLEDGE**

- setup and operation of equipment
- computer programs
- product assembly techniques
- sketching and drawing
- storage systems and labelling
- procedures for the recording, reporting and maintenance of workplace records and information
- appropriate mathematical procedures for estimation and measurement.

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

- Effectively produce ideation drawings to establish the sense and look of a product in story form, working through the design process in readiness for the final working drawings
- Effectively apply design elements and principles to the ideation drawings
- Effectively produce ideation drawings in accordance with the design brief
- Comply with legislation, regulations, standards, codes of practice and established safe practices and procedures for producing ideation drawings
- Communicate effectively and work safely with others in the work area

**Context of and specific resources for assessment**

- The application of competency is to be assessed in the workplace or simulated workplace
- Assessment is to occur under standard and authorised work practices, safety requirements and environmental constraints
- Assessment of essential underpinning knowledge, other than confirmatory questions, will usually be conducted in an off-site context
- Assessment is to comply with relevant regulatory or Australian Standards requirements

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>The following resources should be made available:               <ul style="list-style-type: none"> <li>workplace location or simulated workplace</li> <li>materials and equipment relevant to producing ideation drawings</li> <li>specifications and work instructions</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must satisfy the endorsed assessment guidelines of the Furnishing Industry Training Package</li> <li>Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>Assessment may be in conjunction with assessment of other units of competency</li> </ul>
<b>Guidance information for assessment</b>	

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>OHS requirements</b>	<ul style="list-style-type: none"> <li>are to be in accordance with Commonwealth, State or Territory legislation and regulations,</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>organisational safety policies and procedures</li> <li>requirements may include but not be limited to the use of personal protective equipment and clothing, fire fighting equipment, first aid equipment, hazard and risk control and elimination of hazardous materials and substances, manual handling, including lifting and carrying</li> </ul>
<b>Legislative requirements</b>	<ul style="list-style-type: none"> <li>are to be in accordance with applicable legislation from all levels of government that affect organisational operation</li> <li>requirements may include but not be limited to award and enterprise agreements, industrial relations, Australian Standards, confidentiality and privacy, OHS, the environment, equal opportunity, anti-discrimination, relevant industry codes of practice, duty of care and heritage</li> </ul>
<b>Organisational requirements</b>	<ul style="list-style-type: none"> <li>may include but not be limited to legal, organisational and site guidelines, policies and procedures relating to own role and responsibility, quality assurance, procedural manuals, quality and continuous improvement processes and standards, OHS, emergency and evacuation, ethical standards, recording and reporting, access and equity principles and practices, equipment use, maintenance and storage, environmental management (waste disposal, recycling and re-use guidelines)</li> </ul>
<b>Design brief</b>	<ul style="list-style-type: none"> <li>is to include the aims, objectives, milestones for the design project, the point of reference for everyone, elements and principles of design and may include organisational or personal profiles, aims, target audience, budget, timeline, consultation requirements, colour requirements, image requirements and function</li> </ul>
<b>Appropriate personnel</b>	<ul style="list-style-type: none"> <li>may include but not be limited to trainers, supervisors, suppliers, clients, colleagues and managers</li> </ul>
<b>Ideation drawings</b>	<ul style="list-style-type: none"> <li>are to include freehand drawings which represent a product as a story and methodology to the design brief solution. These are often drawn as thumbnail sketches</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Drawing equipment</b>	<ul style="list-style-type: none"> <li>may include but not be limited to drawing tables, colouring pencils, pens, pastels, paints, pencils, pens, technical drawing pens, computers and computer aided drafting (CAD) software packages</li> </ul>
<b>Communication</b>	<ul style="list-style-type: none"> <li>may include verbal and non-verbal language, constructive feedback, active listening, questioning to clarify and confirm understanding, use of positive, confident and cooperative language, use of language and concepts appropriate to individual social and cultural differences, control of tone of voice and body language</li> </ul>
<b>Concepts</b>	<ul style="list-style-type: none"> <li>are to include ideas generated to respond to the design brief through both ideation drawings or sketching and written explanation</li> </ul>
<b>Thumbnails</b>	<ul style="list-style-type: none"> <li>are to include a series of quick line drawings which explore and demonstrate the design ideas in basic terms, these are completed in freehand and can also be used to provide detail of parts in rough scale</li> </ul>
<b>Specifications</b>	<ul style="list-style-type: none"> <li>are to include the measurements, procedures by which a product is constructed and materials to be utilised</li> </ul>
<b>Working drawings</b>	<ul style="list-style-type: none"> <li>may include but not be limited to drafted technical drawings or drawings produced on computer using CAD software packages. These usually contain project specifications</li> </ul>
<b>Elements of design</b>	<ul style="list-style-type: none"> <li>may include but not be limited to line, shape, form (geometric or organic), texture, colour, and function</li> </ul>
<b>Principles of design</b>	<ul style="list-style-type: none"> <li>may include but not be limited to balance, proportion (symmetry, asymmetry), harmony, contrast, pattern, movement, rhythm, unity, style, focus, scale, dominant, sub dominant or subordinate relationship, emphasis, proximity, alignment, space, anthropometry, ergonomics, arrangement, workload, materials handling capacity, skills, control, equipment capabilities, aesthetic relations, tension and development methods</li> </ul>
<b>Records and reports</b>	<ul style="list-style-type: none"> <li>may include but not be limited to the sketching and drawing method, product type,</li> </ul>



**RANGE STATEMENT**

	size, inspection and labelling outcomes, storage locations, quality outcomes, hazards, incidents or equipment malfunctions
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**Unit Sector(s)**

<b>Unit sector</b>	Furniture design and technology.
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

# LMTGN4002A Participate in product engineering

## Modification History

Not applicable.

## Unit Descriptor

**Unit descriptor** This unit covers the skills and knowledge required to participate in product engineering in a textiles, clothing and footwear (TCF) enterprise.

## Application of the Unit

**Application of the Unit** This unit applies to participating in product engineering in a TCF workplace where judgement may be required in planning and selecting appropriate processes or procedures for self and others. Work may be conducted in a variety of environments, including operational workplace activities, restricted space, hazardous, controlled or exposed conditions.

TCF production areas may include:

- textile production
- clothing production
- footwear production
- early stage wool processing
- cotton ginning
- leather production
- millinery
- canvas and sails production
- laundry operations
- dry cleaning operations

Product engineering may occur in relation to repetitive production runs, short runs and quick changes and can relate to fabrics, fibres, yarns, design varieties, weaves, dyes, finishes, etc.

Work may be conducted in small to large scale enterprises and may involve individual and team activities. Work is performed within defined procedures under direct supervision.

The unit is applied according to OHS and workplace practices of the

enterprise, which may include:

- requirements prescribed by legislation, awards, agreements and conditions of employment
- standard operating procedures
- work instructions
- oral, written and visual communication
- quality practices, including responsibility for maintenance of own work quality and contribution to quality improvement of team/section output
- housekeeping
- tasks related to environmental protection, waste disposal, pollution control and recycling

This unit requires the application of skills associated with communication to interpret production specifications, calculate costs, maintain records and prepare reports. Initiative and enterprise, planning and organising and problem solving are required to examine production options and determine required variations to specifications, processes and schedules. This unit also requires an ability to learn and apply new information. Self management skills are used to ensure work meets quality and work standards.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

**Prerequisites**

## **Employability Skills Information**

**Employability Skills** This unit contains employability skills.

## **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

ELEMENTS	PERFORMANCE CRITERIA
1 Identify and confirm specifications	1.1 Sample material or product is examined to confirm structure 1.2 Detail of structure or composition is documented, where required, to assist in production planning
2 Identify options for production	2.1 Evaluation of material or product structure is conducted to identify options for production 2.2 Options are assessed to determine most effective and efficient <b>method of production</b> , ensuring highest quality and yield from raw materials, and ease of production 2.3 Options and recommendations are documented in accordance with workplace practices and <b>OHS practices</b>
3 Identify potential machine or production changes	3.1 Existing resources, machines, production techniques and scheduling arrangements are examined in relation to the production requirements 3.2 Any potential requirements for change are identified and documented in accordance with workplace practices
4 Prepare <b>cost</b> estimates	4.1 Material requirements and economic batch sizes are identified 4.2 Labour hours, times and other statistics required are identified and estimates made 4.3 Available machine hours are determined and estimates made, where required 4.4 Overall costs are estimated and documented in accordance with workplace practices
5 Maintain records	5.1 Production planning records are maintained and reports prepared, where necessary, in accordance with workplace practices

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge and their level, required for this unit

Demonstrates knowledge of:

- machines and their capabilities
- quality assurance processes; production processes and software
- products produced by the workplace and material or fabric structure (techniques)
- work and workplace organisation systems
- safety and environmental aspects of relevant workplace activities
- OHS practices, including hazard identification and control measures

## REQUIRED SKILLS AND KNOWLEDGE

- quality practices
- workplace practices
- recording and reporting practices

Demonstrates skills to:

- determine structure and composition of material or product
- make calculations, interpret and use data from various sources
- read, interpret and follow information on work specifications, standard operating procedures and work instructions and other reference material
- maintain accurate records
- communicate within the workplace
- sequence operations
- meet specifications
- clarify and check task-related information
- carry out work according to OHS practices

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

### Critical aspects of evidence to be considered

Demonstrates skills and knowledge to:

- confirm specifications
- assess options for method of production
- establish potential machine and production changes
- estimate costs
- apply OHS practices in production operations
- maintain accurate records

### Consistency in performance

Consistently applies skills and knowledge when:

- organising work
- completing tasks
- identifying improvements
- using workplace practices
- using OHS practices
- recording and reporting accidents and incidents
- assessing operational readiness of equipment used and work processes

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.

- recognising and adapting to cultural differences in the workplace, including modes of behaviour and interactions
- completing work systematically with attention to detail without damage to goods and equipment

**Resource implications**

Access is required to real or appropriately simulated situations, including work areas, materials and equipment, and to information on workplace practices and OHS practices.

**Context for assessment**

Assessment may occur on the job or in an appropriately simulated environment.

**Interdependent Assessment**

This unit may be assessed independently or in combination with other relevant units.

## Range Statement

### RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the Performance Criteria, is detailed below. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs if the candidate, accessibility of the item, and local industry and regional contexts.

**Legislative/regulatory requirements** All work must comply with relevant Federal and State or Territory legislative or regulatory requirements.

**Method of production may include:**

- JIT
- VAM
- quick response
- quality circles,
- team processes
- benchmarking

**Cost estimating may include:**

- written bill of labour, order of work or plant sample

**OHS practices** OHS practices must include hazard identification and control, risk assessment and implementation of risk reduction measures specific to the tasks described by this unit, and may include:

- manual handling techniques
- standard operating procedures
- personal protective equipment
- safe materials handling
- taking of rest breaks
- ergonomic arrangement of workplaces
- following marked walkways
- safe storage of equipment
- housekeeping
- reporting accidents and incidents
- other OHS practices relevant to the job and enterprise

## **Unit Sector(s)**

**Sector** All

## **MEA101B Interpret occupational health and safety practices in aviation maintenance**

### **Modification History**

Minor formatting and editorial changes made.

### **Unit Descriptor**

This unit of competency covers the competencies required to comply with occupational health and safety (OHS) regulations and work safely in aircraft maintenance areas and incorporates the requirements of NOHSC:7025(1998) Generic Competency A. Where a CASA licensing outcome is sought this unit forms part of the CASA requirement for the granting of the chosen Aircraft Maintenance Engineer licence under CASR Part 66, in accordance with the licensing provisions in the Assessment Guidelines.

### **Application of the Unit**

This unit requires application of OHS practices relevant to aviation maintenance workplaces in order to ensure own safety and that of others in the workplace.

Applications include the performance of maintenance activities on fixed or rotary wing aircraft on the flight line or tarmac, in the hanger, including during functional testing of systems and in the workshop environment.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |   |  |
|---|--|
| 1. Interpret safe work practices                        | <p>1.1. <b><i>Relevant regulatory and enterprise policies and procedures</i></b> that identify the <b><i>requirements for conduct of safe work</i></b> are interpreted and understood</p> <p>1.2. Workplace housekeeping measures are identified in accordance with standard enterprise procedures</p> <p>1.3. Use of <b><i>personal protective equipment</i></b> and clothing is identified and understood and maintenance measures are interpreted and understood according to regulatory and enterprise procedures</p> <p>1.4. Safety signs and symbols are interpreted and understood, and their directions observed in accordance with enterprise and safety requirements</p> |
| 2. Interpret reporting procedures for workplace hazards | <p>2.1. Workplace hazards are correctly identified and reporting procedures interpreted and understood according to standard enterprise procedures</p>   |
| 3. Interpret emergency procedures                       | <p>3.1. Method of contacting the appropriate personnel and emergency services in the event of an accident is appropriate to enterprise requirements</p> <p>3.2. Emergency and evacuation procedures are interpreted and understood to ensure safe conduct of personnel according to enterprise procedures</p> <p>3.3. Use of emergency equipment is correctly identified to comply with regulatory or enterprise procedures</p>  |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- correctly interpreting OHS regulations, instructions and procedures relevant to the range of applications listed in the Range Statement

- recognising and adhering to aerospace industry signage, including aircraft systems plumbing markings
- recognising and reporting to designated personnel hazardous situations in the workplace
- risk assessment and control
- selecting appropriate protective clothing for the maintenance activity being undertaken
- correct interpretation of enterprise and regulatory emergency procedures
- correct identification and operation of enterprise/industry specific workplace emergency equipment
- application of first aid procedures, such as DRABC

## Required knowledge

Look for evidence that confirms knowledge of:

- the applicable sources of OHS requirements and procedures and their application in workplace situations as listed in the Range Statement
- how to recognise and report hazardous situations in the workplace
- methods of risk assessment and control
- the preferred order of ways to control risks (known as the hierarchy of control)
- work operations to control risks, e.g. permit to work systems, such as confined space entry and isolation procedures
- how to determine requirements for personal protective equipment associated with maintenance activities
- the correct selection and use of workplace emergency equipment
- action to be taken in emergency situations
- first aid procedures

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to correctly interpret and apply all relevant OHS procedures and standard processes in the aviation maintenance environment.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

This unit must be related in its assessment and application to all other units. The relationship between general workplace OHS requirements, as included in enterprise procedures, and the relevant federal and/or

	<p>state and territory legislation must be clearly linked.</p> <p>Evidence of knowledge and skills associated with the application of OHS standards is required to supplement evidence of ability to interpret and apply specific safe practices in the workplace.</p> <p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency under routine supervision on at least one item against each Group 1 to 10 (Groups 11 and 12 must also be included if applicable to the enterprise) as listed in the Range Statement. This shall be established via the records in the Log of Industrial Experience and Achievement or, where appropriate, an equivalent Industry. The relationship between general workplace OHS requirements, as included in enterprise procedures, and the relevant federal and/or state and territory legislation must be clearly linked.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. Should a demonstration of skill application be necessary, the candidate must have access to all necessary tools, equipment, materials and relevant documentation. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate,

accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Note</b>	Range statements listed below are numbered to facilitate specification of the assessment requirements included in the Evidence Guide
<b>Requirements for conduct of safe work</b>	<p>The requirements for conduct of safe work may cover:</p> <ol style="list-style-type: none"> <li>1. Applying general duty of care under OHS legislation and common law</li> <li>2. Fluid and gas high and low pressure systems, including fluid handling (for example, hydraulic fluids, lubricants, compressed air, nitrogen and oxygen)</li> <li>3. Fuelling/defuelling and working on fuel systems, including confined space entry</li> <li>4. Using and handling chemicals, including solvents, battery acids</li> <li>5. Electrical systems, outlets and leads</li> <li>6. Noise hazard areas and aircraft safety zones</li> <li>7. Aircraft handling, towing, jacking, ground equipment operation and signage</li> <li>8. Personal protection</li> <li>9. First aid</li> <li>10. Housekeeping and cleaning, waste disposal and FOD prevention practices and procedures</li> <li>11. Aircraft strobe lighting</li> <li>12. Ionising, non-ionising radiation equipment</li> </ol>
<b>Application</b>	Application of this unit of competency relates to all aviation maintenance workplace environments
<b>Relevant regulatory and enterprise policies and procedures</b>	<p>Relevant regulatory and enterprise policies and procedures may be found in:</p> <ul style="list-style-type: none"> <li>• Commonwealth, State and Territory OHS Acts, regulations and codes of practice, including regulations and codes of practice relating to hazards present in the workplace or industry</li> <li>• organisational safety manuals that specify provisions relating to roles and responsibilities of health and safety representatives and/or OHS committees and provisions relating to OHS issue resolution</li> <li>• maintenance organisation manual</li> <li>• procedures manuals</li> </ul>

	<ul style="list-style-type: none"> <li>• work instructions</li> <li>• relevant Defence Instructions</li> <li>• Civil Aviation Safety Regulations</li> </ul>
<b>Personal protective equipment and clothing requirements</b>	<p>Personal protective equipment and clothing requirements may be found in:</p> <ul style="list-style-type: none"> <li>• MSDS</li> <li>• safety manual</li> <li>• procedures manual</li> <li>• maintenance manual</li> <li>• work instructions</li> <li>• relevant defence instructions</li> </ul>
<b>Workplace hazards</b>	<p>Workplace hazards are correctly identified through:</p> <ul style="list-style-type: none"> <li>• checking equipment or the work area before work commences and during work</li> <li>• workplace inspections</li> <li>• housekeeping</li> </ul>

## Unit Sector(s)

Aviation maintenance

## Competency field

Not applicable

## Co-requisite units

Not applicable

## **MEA105C Apply quality standards applicable to aviation maintenance processes**

### **Modification History**

Additional knowledge requirements regarding inspection - units are equivalent.

### **Unit Descriptor**

This unit of competency is applicable to all Aeroskills Maintenance training pathways. It covers the competencies required to correctly apply quality standards applicable to the maintenance of aircraft and aircraft components, either individually, or as a member of a team. The unit is used in workplaces that operate under the airworthiness regulatory systems of the ADF and CASA.

Where a CASA licensing outcome is sought this unit forms part of the CASA requirement for the granting of the chosen Aircraft Maintenance Engineer Licence under CASR Part 66, in accordance with the licensing provisions in the Assessment Guidelines.

### **Application of the Unit**

This unit requires application of quality standards in the performance of aviation maintenance activities.

Applications include flight line/tarmac, hangar and workshop maintenance tasks.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA101B Interpret occupational health and safety practices in aviation maintenance

MEA107B Interpret and use aviation maintenance industry manuals and specifications

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |                                 |   |
|---------------------------------|---|
| 1 Interpret quality standards   | <p>1.1 Standards or specifications set out in maintenance documents and process specifications are identified and interpreted</p> <p>1.2 Enterprise quality requirements are identified and confirmed</p>   |
| 2 Apply quality standards       | <p>2.1 Standards are applied appropriately for individual and team-related activities</p> <p>2.2 Defects within the quality system are detected and reported in accordance with standard procedures</p> <p>2.3 Documentation is handled and completed accurately and clearly to enable information to be easily read or interpreted</p> |
| 3 Interpret quality improvement | <p>3.1 Performance monitoring measures are identified to ensure product or service standards are maintained or improved</p>   |

## Required Skills and Knowledge

Look for evidence that confirms knowledge of:

- typical quality systems and their operation in the workplace
- workplace quality documentation such as quality manuals, procedures manuals, work instructions and worksheets
- the relationship between the quality system and OHS requirements, such as workplace hazard reporting
- the relationship between the quality system and identification systems for aircraft hardware, materials and components
- the role of inspection in maintaining aircraft continuing airworthiness and reliability, including ageing aircraft inspection requirements
- how inspection programs are derived and developed
- individual and organisational responsibility associated with 'on condition' maintenance

- inspection terminology and standards of inspection with regard to the quality system
- identifying potential areas for inspection process improvement as a quality system activity

Look for evidence that confirms skills in:

- the application of workplace hazard reporting and identification procedures
- interpretation and application of information from a range of industry manuals, in particular, amendment status block information, amendment procedures, specification/modification leaflet applicability and changes to drawings
- the correct identification of aircraft hardware, materials and components by marking, part number, size and shape
- being able to differentiate the elements which constitute the system and able to identify processes, workplace regulations and ISO 9000 compliant documentation and specifications within the workplace environment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to interpret and apply quality systems in the workplace and interface quality requirement with OHS procedures and identification systems for aircraft hardware, materials and components.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>The relationship between broader quality standards requirements and service specific procedures must be clearly linked. It is essential that actual and potential defects within the quality system are considered, together with ongoing abnormalities of equipment or systems as they affect the quality system.</p> <p>Evidence of underlying knowledge and skills associated with the general application of quality standards is required to supplement evidence of ability to integrate these processes in conjunction with other personnel in the workplace.</p> <p>A person cannot be assessed as competent until it can be demonstrated to the satisfaction of the workplace assessor that the relevant elements of the unit of competency are being achieved under routine supervision in both single and multiple tasks involving more than one person. This shall be established via the records in the Log of Industrial Experience and Achievement or, where</p>



	appropriate, an equivalent Industry Evidence Guide.
<b>Context of and specific resources for assessment</b>	Competency should be assessed in the work environment, or by use of simulated activities, covering the application of quality standards in situations within the aircraft maintenance environment.  This unit must be related in its assessment and application to all other units.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Application</b>	Application of this unit may relate to: <ul style="list-style-type: none"> <li>• scheduled or unscheduled maintenance</li> <li>• team-related activities</li> <li>• single or multiple tasks</li> </ul>
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## Unit Sector(s)

Aviation maintenance

## Custom Content Section

Not applicable.

# **MEA107B Interpret and use aviation maintenance industry manuals and specifications**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit of competency is applicable to all Aeroskills training pathways. It covers the competencies required to use and correctly interpret industry manuals, specifications and drawings used in the maintenance and manufacture of aircraft and aircraft components. Where a CASA licensing outcome is sought this unit forms part of the CASA requirement for the granting of the chosen Aircraft Maintenance Engineer Licence under CASR Part 66, in accordance with the licensing provisions in the Assessment Guidelines.

## **Application of the Unit**

This unit requires application of the information contained in industry manuals and specifications in the performance of aviation maintenance activities.

Applications include on-aircraft and workshop-related activities.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |  |  |
|--|--|
| 1. Identify and access industry manuals, specifications and drawings | 1.1. <b><i>Appropriate manuals</i></b> are identified and accessed for the type of aircraft or component to be maintained<br>1.2. Amendment status is clearly established to ensure the correct specifications and procedures are applied    |
| 2. Interpret information   | 2.1. Relevant chapter or section of manual or drawing is located in relation to the work to be carried out<br>2.2. Information is interpreted and procedures to be followed are accurately determined  |
| 3. Apply information   | 3.1. Work steps are correctly identified in accordance with manual or specification procedures<br>3.2. All correct sequencing and adjustments are interpreted in accordance with information contained in industry manuals or specifications |
| 4. Amend manuals, specifications or drawings                         | 4.1. Manual, specification or drawing changes and/or amendments are incorporated and documented correctly in accordance with <b><i>statutory regulations and/or enterprise procedures</i></b>  |
| 5. Store manuals, specifications or drawings                         | 5.1. Manuals, specifications or drawings are stored appropriately to ensure prevention of damage, ready access and updating of information, when required, in accordance with regulatory and/or enterprise procedures                        |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- accessing and interpreting information from industry manuals, including paper-based, microfiche or computer-based media, relating to work activities, including determination of manual amendment status, knowledge of manual

- structures and locating relevant information/instructions for work activity
- amending industry manuals to reflect current/approved amendment status
- identifying and interpreting information from drawings and diagrams in aircraft maintenance manuals, including component scaling, section, assembly, location, drawing applicability and amendment status from the title block
- correct handling and storage of drawings, manuals and industry media, i.e. microfiche and digital formats
- calculating allowable dimension variations on a component from information in drawing title blocks and drawings
- calculating dimensions from drawings for the purpose of manufacturing aircraft components and hardware

### Required knowledge

Look for evidence that confirms knowledge of:

- the types of industry manuals used in aviation maintenance and types of media
- requirements for custody and upkeep of industry manuals
- techniques for obtaining and applying data contained in industry manuals

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to correctly interpret the information in industry manuals and specifications and apply that information during the performance of aviation maintenance tasks.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>The transferability of general manual interpretation and use in accordance with relevant aircraft publications/maintenance regulations/orders and standards and practices must be clearly established.</p> <p>Evidence of underlying knowledge and skills associated with the interpretation and use of manuals is required to supplement understanding of the structure and regulatory requirements associated with the aircraft maintenance environment in this area.</p> <p>A person cannot be assessed as competent until it can be demonstrated to the satisfaction of the workplace assessor that the relevant elements of the Unit of Competency are being achieved under routine supervision on at least one manual from each of Groups</p>

	1, 2 and 3 listed in the Range Statement. This shall be established via the records in the Log of Industrial Experience and Achievement or, where appropriate, an equivalent Industry .
<b>Context of and specific resources for assessment</b>	Competency should be assessed in the work environment, or by use of simulated activities, covering the interpretation and use of Enterprise Aviation manuals, aircraft publications, process sheets, specifications and drawings applicable to the aircraft maintenance environment.  This unit must be linked in its assessment and application to those that apply to the actual maintenance of aircraft.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.	
<b>Note</b>	The Range Statements below are numbered to facilitate specification of the assessment requirements included in the Evidence Guide
<b>Types of manual</b>	Appropriate manuals may include: <ol style="list-style-type: none"> <li>1. Aircraft publications, maintenance instruction manuals, process specifications, servicing or service bulletins or structural repair manuals</li> <li>2. Tooling or equipment manuals, manufacturer's manuals, standard practices, enterprise aviation regulations and publications</li> <li>3. Illustrated parts catalogues, aircraft wiring manuals or drawings</li> </ol>
<b>Statutory regulations and/or enterprise procedures</b>	Statutory regulations and/or enterprise procedures may include: <ul style="list-style-type: none"> <li>• civil aviation regulations or civil aviation safety</li> </ul>

	<p>regulations</p> <ul style="list-style-type: none"><li>• applicable defence regulations and instructions</li><li>• maintenance organisation manual</li><li>• standing instructions</li></ul>
<b>Application</b>	Application of this unit may relate to both on-aircraft and workshop-related activities in the aircraft maintenance environment

## Unit Sector(s)

Aviation maintenance

## Competency field

## Co-requisite units

Not applicable

# **MEA108B Complete aviation maintenance industry documentation**

## **Modification History**

Release 3 - Typographical error corrected in Required Skills - equivalent

Release 2 - Minor formatting and editorial changes made. Prerequisite unit version updated.

## **Unit Descriptor**

This unit of competency is applicable to all Aeroskills training pathways. It covers the competencies required to correctly interpret, use and complete documentation associated with aircraft and aircraft component maintenance and manufacture. Where a CASA licensing outcome is sought this unit forms part of the CASA requirement for the granting of the chosen Aircraft Maintenance Engineer Licence under CASR Part 66, in accordance with the licensing provisions in the Assessment Guidelines.

## **Application of the Unit**

This unit requires application of skills and knowledge relating to the requirements for the completion and processing of documentation during, and on completion of, aviation maintenance activities.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEA105C	Apply quality standards applicable to aviation maintenance processes
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## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |                                       |  |
|---------------------------------------|--|
| 1. Interpret documentation            | <p>1.1. <b><i>Documentation</i></b> requirements are determined and accessed, where necessary, from relevant sources in accordance with regulatory and enterprise procedures</p> <p>1.2. Information contained in existing documentation is interpreted correctly and, where necessary, requirements carried out in accordance with <b><i>regulatory and enterprise procedures</i></b></p> |
| 2. Complete documentation             | <p>2.1. Information requirements for new documentation or updating of existing documentation are determined to allow for accurate completion of records</p> <p>2.2. Documentation is completed accurately and clearly to enable information to be easily read or interpreted</p>   |
| 3. Store and distribute documentation | <p>3.1. All procedures for storing and distributing documentation are followed to ensure ready access when required in accordance with regulatory and enterprise procedures</p>  |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- identification and accurate completion of industry documentation associated with aircraft/aircraft component maintenance, repair, overhaul and modification activities, industry regulatory reports and OHS hazard reporting formats
- handling industry documentation appropriately to ensure that records are accurately processed, forwarded and/or stored as required by industry and enterprise regulations

### Required knowledge

Look for evidence that confirms knowledge of:



- maintenance practice terminology and the associated relationship with industry documentation, i.e. scheduled and unscheduled servicing, aircraft/component lifing, i.e. on condition, life expired, throwaway, repair and overhaul

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to correctly complete and process maintenance documentation applicable to maintenance tasks that are being performed.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that information generated in the process of completing paperwork is in a form which is acceptable to the workplace environment and regulatory requirements in accordance with the relevant aircraft publications/maintenance regulations/orders and standards and practices.</p> <p>Evidence of underlying knowledge and skills associated with the interpretation and completion of paperwork is required to supplement evidence of appropriate levels of literacy and numeracy, associated with presenting clear and concise information.</p> <p>A person cannot be assessed as competent until it can be demonstrated to the satisfaction of the workplace assessor that the relevant elements of the unit of competency are being achieved under routine supervision on at least one type of documentation from each of Groups 1 and 2 from the Range Statement.</p> <p>This shall be established via the records in the Log of Industrial Experience and Achievement or, where appropriate, an equivalent Industry .</p>
<b>Context of and specific resources for assessment</b>	<p>Competency should be assessed in the work environment, or by use of simulated activities, covering the interpretation, use and completion of aircraft maintenance documentation in the maintenance environment in accordance with relevant aircraft publications/maintenance regulations/orders and standards and practices.</p> <p>This unit must be linked in its assessment and application</p>

	to those that apply to the actual maintenance of aircraft.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Note</b>	Range statements listed below are numbered to facilitate specification of the assessment requirements included in the Evidence Guide
<b>Documentation</b>	Documentation may include: 1. Maintenance logs, overhaul test/check sheets, job history sheets, traveller cards, maintenance reports, irregularity reports, serviceable tags or removal tags 2. MSDS or material record sheets
<b>Regulatory and enterprise procedures</b>	Regulatory and enterprise procedures may be found in: <ul style="list-style-type: none"><li>• CARs or CASRs</li><li>• maintenance organisation manual</li><li>• procedures manual</li><li>• work instructions</li><li>• quality manual</li><li>• safety manual</li><li>• applicable defence regulations and instructions</li><li>• standing instructions</li></ul>
<b>Application</b>	Application of this unit may relate to on-aircraft and workshop-related activities in the aircraft maintenance environment

## **Unit Sector(s)**

Aviation maintenance

## **Competency field**

Not applicable.

## **Co-requisite units**

Not applicable

## **MEA109B Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance**

### **Modification History**

Minor formatting and editorial changes made. Prerequisite unit version updated.

### **Unit Descriptor**

This unit of competency is applicable to all Aeroskills Maintenance training pathways. It covers the competencies required to perform basic hand skills, apply standard trade practices and fundamentals relevant to the maintenance of aircraft and aircraft components. Where a CASA licensing outcome is sought this unit forms part of the CASA requirement for the granting of the chosen Aircraft Maintenance Engineer Licence under CASR Part 66, in accordance with the licensing provisions in the Assessment Guidelines.

### **Application of the Unit**

This unit requires application of basic hand skills and standard trade practices in the maintenance of aircraft and aircraft components.

Applications include the use of hand and power tools, and the selection and use of aircraft hardware.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA105C	Apply quality standards applicable to aviation maintenance processes
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MEA108B	Complete aviation maintenance industry documentation
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## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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### Elements and Performance Criteria

- |                                   |  |
|-----------------------------------|--|
| 1. Assess task requirements       | 1.1.Available information from relevant documentation and/or other sources, including communication with other personnel, is interpreted and assessed to determine the task and tooling requirements   |
| 2. Select tools and/or equipment  | 2.1.Hand and/or power tools or equipment are selected for appropriate application to the required task<br>2.2.All tools and/or equipment to be used are checked for condition or calibration, where necessary<br>2.3.Unsafe or faulty tools or equipment are identified and marked for repair according to enterprise procedures                   |
| 3. Use tools and/or equipment     | 3.1.Tools and/or equipment are used according to standard practices to ensure the correct outcome is produced<br>3.2.Tools and/or equipment use is carried out without damage to components or tooling in a safe and efficient manner<br>3.3.Operational maintenance of tools or equipment is undertaken according to standard workshop procedures |
| 4. Store tools and/ or equipment  | 4.1.Tools and/or equipment are stored safely and securely in accordance with enterprise procedures   |
| 5. Apply standard trade practices | 5.1.Simple items are manufactured using basic engineering hand skills<br>5.2.Common types of aircraft attachment hardware are correctly selected and used<br>5.3.Common types of safety locking devices and fasteners are correctly selected and used<br>5.4.Aircraft components, devices and hardware are lockwired in the                        |

correct manner, using the appropriate wire gauge

5.5. Common types of aircraft connectors and plumbing are accurately assembled or connected

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- the correct identification, inspection of, application, use and storage of general and purpose specific hand tools (i.e. spanners, screwdrivers, pliers, hammers, cutting devices, files, punches, drills and marking out tools) that may be found in an aircraft engineering workshop or hangar
- the correct identification, inspection of (including calibration), application, use and storage of precision measuring tools (i.e. micrometers, vernier instruments, feeler gauges, go/no-go gauges) that may be found in an aircraft engineering workshop or hangar. Reading instrument scales must be clearly demonstrated during application of instruments to ensure compliance with specifications
- the correct identification, inspection of, application, operation and storage/servicing of portable and fixed power and machine tools (i.e. drills, presses, grinders, shears, pan breaks) that may be found in an aircraft engineering workshop or hangar
- identification, inspection and use of lubrication equipment
- determination of correct lubricants for specified applications
- identification of common ferrous and non-ferrous aircraft materials
- identification of common aircraft composite and non-metallic materials (other than wood)
- identification of aircraft hardware by markings, part numbers, size, shape and material
- the installation of aircraft hardware using standard practices/techniques to ensure safe security and includes:
  - minimum thread engagement
  - split pinning
  - lockwiring
  - application of locking compounds
  - locking tabs, spring washers
  - lock nuts
- the installation of aircraft hardware using tightening, torquing and tensioning techniques. Calculating setting, reading scales and setting up of torque wrench and/or tensioning devices must be clearly demonstrated before application of wrench or device
- identification of various types of aircraft rigid and flexible plumbing and their

connectors

- identification of aircraft control cables and related cable system hardware

## Required knowledge

Look for evidence that confirms knowledge of:

- types of standard aircraft hardware and methods of identification, including bolts, nuts, washers, pins (cotter, tapered), and fasteners (rivets and camlocs)
- materials from which hardware is manufactured and its applications, including plain, corrosion resistant and temperature/heat resistant
- types of safety locking devices and their application
- common ferrous and non-ferrous aircraft materials, heat treatment and testing
- characteristics and properties of common composite and non-metallic materials other than wood
- types of aircraft cable, turnbuckles, end fittings, tensiometers, pulleys and cable system components, aircraft flexible control systems
- types and characteristics of lubricants
- types and uses of lubrication equipment
- fits and clearances
- hand and power tool storage and maintenance requirements
- tool calibration requirements
- OHS requirements relation to the use of hand and power tools

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to use aviation maintenance hand and power tools to lay out and fabricate simple items, correctly assemble items and apply safety locking devices.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

This unit must be linked in its assessment and application to those units that apply to actual maintenance of aircraft. It is essential that all OHS requirements are met and understood.

Evidence of knowledge about how tools and equipment are selected, used and maintained is essential. The ability to manipulate tools and equipment correctly in the performance of tasks is necessary to demonstrate transferability of hand skills across a variety of

	<p>applications.</p> <p>A person cannot be assessed as competent until it can be demonstrated to the satisfaction of the workplace assessor that the relevant elements of the unit of competency are being achieved under routine supervision on the tasks listed in Groups 1 to 4 in the Range Statement. This shall be established via the records in the Log of Industrial Experience and Achievement or, where appropriate, an equivalent Industry.</p>
<b>Context of and specific resources for assessment</b>	Competency should be assessed in the work environment, or by use of simulated activities, using tools and equipment specified by aircraft manuals as well as general purpose tools and test equipment found in most routine situations. It is expected that the person operating these tools and equipment would be able to demonstrate a broad application of their skills.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Note</b>	Range statements listed below are numbered to facilitate specification of the assessment requirements included in the Evidence Guide
<b>Application of competency</b>	<p>The competency applies to the selection and use of hand and power tools and equipment associated with on-aircraft or workshop related activities in the aircraft maintenance environment that involve:</p> <ol style="list-style-type: none"> <li>1. Laying out and fabricating simple items from common aircraft materials</li> <li>2. Assembling items using a representative range of common types of aircraft attachment hardware for which relevant fits and clearances, appropriate safety locking</li> </ol>



	<p>devices and fasteners, including lockwire, are correctly selected and applied</p> <p>3. Assembling/connecting a range of common aircraft connectors and plumbing, applying safety locking devices, where applicable</p> <p>4. Assembling/connecting aircraft control cables and applying safety locking devices, where applicable</p>
<b>The use of tools and equipment</b>	The use of tools and equipment includes the related manipulative skills required to perform maintenance
<b>Application</b>	<p>Application of this unit may relate to:</p> <ul style="list-style-type: none"><li>• scheduled or unscheduled maintenance activities</li><li>• individual or team-related activities</li></ul>
<b>Procedures and requirements</b>	Refer to industry standard procedures specified by manufacturers, regulatory authorities or the enterprise

## Unit Sector(s)

Aviation maintenance

## Competency field

## Co-requisite units

Not applicable

# MEA270A Lay out avionic systems

## Modification History

Minor formatting and editorial changes made.

## Unit Descriptor

This unit is part of Diploma and Advanced Diploma training pathways. It covers the basic design and layout to block diagram level of avionic systems.

## Application of the Unit

This unit requires application of basic knowledge of avionic system function, design and layout.

Applications include typical electrical and instrument systems.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |   |  |
|---|--|
| 1. Lay out to block diagram level an aircraft electrical system   | 1.1. The <i>functions of aircraft electrical systems</i> are identified<br>1.2. <i>Aircraft electrical system components</i> are identified<br>1.3. A typical aircraft electrical system is sketched at block diagram level<br>1.4. Aircraft electrical system maintenance requirements are identified |
| 2. Lay out to block diagram level an instrument measuring system  | 2.1. The various <i>instrument measuring systems</i> are identified<br>2.2. <i>Measuring system components</i> are identified<br>2.3. A typical instrument measuring system is sketched at block diagram level<br>2.4. Measuring system maintenance requirements are identified                        |
| 3. Lay out to block diagram level a pressurisation control system | 3.1. <i>Pressurisation control system components</i> are identified<br>3.2. A typical pressurisation control system is sketched at block diagram level<br>3.3. Pressurisation control system maintenance requirements are identified   |
| 4. Lay out to block diagram level an aircraft oxygen system       | 4.1. The various <i>types of oxygen system</i> are identified<br>4.2. <i>Oxygen system components</i> are identified<br>4.3. A typical oxygen system is sketched at block diagram level<br>4.4. Oxygen system maintenance requirements are identified  |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- sketching typical avionic systems at block diagram level

### Required knowledge

Look for evidence that confirms knowledge of:

- DC and AC power generation, control and distribution
- aircraft electrical systems and their components
- aircraft electrical system maintenance requirements
- the atmosphere
- use of synchros and servos
- basics of analogue electronics
- aircraft instrument measuring systems and their components
- aircraft instrument measuring system maintenance requirements
- air conditioning and pressurisation systems
- air conditioning and pressurisation system maintenance requirements
- types of aircraft oxygen systems and their applications
- oxygen system maintenance requirements and related cleanliness and safety precautions

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to identify avionic systems and their components, lay out typical systems at block diagram level and identify related maintenance requirements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.
<b>Context of and specific resources for assessment</b>	This unit may be assessed off the job in a training environment equipped to provide exposure to the range of system types and components. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Application</b>	Application of this unit may relate to individual or team-related activities
<b>Functions of aircraft electrical systems</b>	<p>Functions of aircraft electrical systems may include:</p> <ul style="list-style-type: none"> <li>• power generation, control and distribution</li> <li>• lighting</li> <li>• electrically operated systems, such as doors, flap and landing gear systems</li> <li>• system control (e.g. hydraulic, pneumatic, air conditioning, propeller control and anti-skid)</li> <li>• warning systems</li> <li>• ice and rain protection</li> <li>• engine systems</li> </ul>

<b>Aircraft electrical system components</b>	<p>Aircraft electrical system components may include:</p> <ul style="list-style-type: none"> <li>the major components of each of the above systems that would be shown in a block diagram or schematic</li> </ul>
<b>Instrument measuring systems</b>	<p>Instrument measuring systems may include:</p> <ul style="list-style-type: none"> <li>engine indication</li> <li>transmitter/indicator measuring (pressure, temperature and position)</li> <li>fuel quantity indication and flow indication</li> </ul>
<b>Measuring system components</b>	<p>Measuring system components may include:</p> <ul style="list-style-type: none"> <li>the major components of each of the above systems that would be shown in a block diagram or schematic</li> </ul>
<b>Pressurisation control system components</b>	<p>Pressurisation control system components may include:</p> <ul style="list-style-type: none"> <li>the major components of a pressurisation control system that would be shown in a block diagram or schematic</li> </ul>
<b>Types of oxygen system</b>	<p>Types of oxygen system may include:</p> <ul style="list-style-type: none"> <li>gaseous</li> <li>liquid</li> <li>chemical</li> </ul>
<b>Oxygen system components may include:</b>	<p>Oxygen system components may include:</p> <ul style="list-style-type: none"> <li>the major components of each of the above systems that would be shown in a block diagram or schematic</li> </ul>

## Unit Sector(s)

Avionic engineering

## Competency field

## Co-requisite units

Not applicable

# **MEA271A Lay out avionic flight management systems**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit is part of Diploma and Advanced Diploma training pathways. It covers the basic design and layout to block diagram level of avionic flight management systems.

## **Application of the Unit**

This unit requires application of basic knowledge of avionic flight management systems function, design and layout.

Applications include typical instrument, radio and electronic systems.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance
MEA270A	Lay out avionic systems

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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### Elements and Performance Criteria

- |  |   |
|--|---|
| 1. Lay out to block diagram level a flight instrument system       | 1.1. The various <b><i>aircraft flight instrument systems</i></b> are identified<br>1.2. <b><i>Flight instrument system components</i></b> are identified<br>1.3. A typical advanced flight instrument system is sketched at block diagram level<br>1.4. Flight instrument system maintenance requirements are identified |
| 2. Lay out to block diagram level an instrument navigation system  | 2.1. The various <b><i>instrument navigation systems</i></b> are identified<br>2.2. <b><i>Instrument navigation system components</i></b> are identified<br>2.3. A typical instrument navigation system is sketched at block diagram level<br>2.4. Instrument navigation system maintenance requirements are identified   |
| 3. Lay out to block diagram level an aircraft communication system | 3.1. <b><i>Aircraft communication systems</i></b> are identified<br>3.2. <b><i>Communication system components</i></b> are identified<br>3.3. A typical communication system is sketched at block diagram level<br>3.4. Communication systems maintenance requirements are identified                                     |
| 4. Lay out to block diagram level an                               | 4.1. <b><i>Aircraft pulse systems</i></b> are identified  |



- |   |  |
|---|--|
| aircraft pulse system   | 4.2. <i>Pulse system components</i> are identified                       |
|   | 4.3.A typical pulse system is sketched at block diagram level            |
|   | 4.4.Pulse system maintenance requirements are identified                 |
| 5. Lay out to block diagram level an aircraft radio navigation system | 5.1. <i>Aircraft radio navigation systems</i> are identified             |
|   | 5.2. <i>Radio navigation system components</i> are identified            |
|   | 5.3.A typical radio navigation system is sketched at block diagram level |
|   | 5.4.Radio navigation system maintenance requirements are identified      |
| 6. Lay out to block diagram level an aircraft electronic system       | 6.1. <i>Aircraft electronic systems</i> are identified                   |
|   | 6.2. <i>Electronic system components</i> are identified                  |
|   | 6.3.A typical electronic system is sketched at block diagram level       |
|   | 6.4.Electronic system maintenance requirements are identified            |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- sketching typical avionics systems at block diagram level

### Required knowledge

Look for evidence that confirms knowledge of:

- the atmosphere
- pitot static systems
- magnetism
- function of gyroscopes
- use of synchros and servos
- basics of analogue electronics
- aircraft instrument systems and their components
- aircraft instrument system maintenance requirements
- radio, navigation and radar basics
- aircraft communication, pulse and radio navigation systems and their components
- communication, pulse and radio navigation system maintenance requirements

- basics of digital electronics
- basic computer architecture
- use of data buses
- automatic flight control systems and their components
- automatic engine control systems and their components
- flight management systems and their components
- display systems and their components
- aircraft electronic system maintenance requirements

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to identify avionic systems and their components, lay out typical systems at block diagram level and identify related maintenance requirements. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	This unit may be assessed off the job in a training environment equipped to provide exposure to the range of system types and components. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The assessment environment should not disadvantage the candidate.

<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Application</b>	<p>Application of this unit may relate to:</p> <ul style="list-style-type: none"> <li>individual or team-related activities</li> </ul>
<b>Aircraft flight instrument systems</b>	<p>Aircraft flight instrument systems may include:</p> <ul style="list-style-type: none"> <li>airspeed indication</li> <li>pitot static systems</li> <li>vertical speed indication</li> <li>air data</li> <li>machmeter</li> <li>altimeters, including servo and encoding</li> <li>angle of attack and stall warning/avoidance</li> <li>turn and slip</li> <li>directional gyros</li> <li>artificial horizons</li> <li>attitude heading reference</li> </ul>
<b>Flight instrument system components</b>	<p>Flight instrument system components may include:</p> <ul style="list-style-type: none"> <li>the major components of each of the above systems that would be shown in a block diagram or schematic</li> </ul>
<b>Instrument navigation systems</b>	<p>Instrument navigation systems may include:</p> <ul style="list-style-type: none"> <li>remote reading gyro compass</li> <li>direct reading compass</li> <li>ground proximity warning</li> <li>flight data recording</li> <li>inertial navigation</li> </ul>
<b>Instrument navigation system components</b>	<p>Instrument navigation system components may include:</p> <ul style="list-style-type: none"> <li>the major components of each of the above systems</li> </ul>

	that would be shown in a block diagram or schematic
<b>Aircraft communication systems</b>	<p>Aircraft communication systems may include:</p> <ul style="list-style-type: none"> <li>• HF radio</li> <li>• VHF radio</li> <li>• UHF radio</li> <li>• satellite communications</li> <li>• communications addressing and reporting</li> <li>• audio integration and intercommunications</li> <li>• cockpit voice recording</li> <li>• emergency location</li> </ul>
<b>Communication system components</b>	<p>Communication system components may include:</p> <ul style="list-style-type: none"> <li>• the major components of each of the above systems that would be shown in a block diagram</li> </ul>
<b>Aircraft pulse systems</b>	<p>Aircraft pulse systems may include:</p> <ul style="list-style-type: none"> <li>• navigation radar</li> <li>• search radar</li> <li>• weapons system radar</li> <li>• radar altimeter</li> <li>• air traffic control transponder</li> <li>• distance measuring equipment</li> <li>• tactical air navigation</li> <li>• doppler</li> <li>• collision avoidance</li> </ul>
<b>Pulse system components</b>	<p>Pulse system components may include:</p> <ul style="list-style-type: none"> <li>• the major components of each of the above systems that would be shown in a block diagram</li> </ul>
<b>Aircraft radio navigation systems</b>	<p>Aircraft radio navigation systems may include:</p> <ul style="list-style-type: none"> <li>• instrument landing</li> <li>• automatic direction finding</li> <li>• VHF omni range</li> <li>• global navigation</li> </ul>
<b>Radio navigation system components</b>	<p>Radio navigation system components may include:</p> <ul style="list-style-type: none"> <li>• the major components of each of the above systems that would be shown in a block diagram</li> </ul>
<b>Aircraft electronic systems</b>	<p>Aircraft electronic systems may include:</p> <ul style="list-style-type: none"> <li>• automatic flight control</li> <li>• automatic engine control</li> <li>• electronic instrument display</li> </ul>

	<ul style="list-style-type: none"><li>• flight management</li></ul>
<b>Electronic system components</b>	Electronic system components may include: <ul style="list-style-type: none"><li>• the major components of each of the above systems that would be shown in a block diagram</li></ul>

**Unit Sector(s)**

Avionic engineering

**Competency field****Co-requisite units**

Not applicable

## **MEA272B Apply basic scientific principles and techniques in avionic engineering situations**

### **Modification History**

Additional knowledge requirements - equivalent to previous unit.

### **Unit Descriptor**

This unit of competency covers the application of basic scientific principles and techniques to appropriate avionic engineering situations involving component and system design, modification and engineering support of maintenance.

### **Application of the Unit**

This unit requires application of basic avionic scientific principles and techniques as a member of a design and development team or similar in support of the design and development of avionic applications, or as a member of a maintenance organisation engineering department.

Applications include identifying the range of basic avionic scientific principles and techniques relevant to avionic engineering, selecting avionic principles and techniques for particular applications, applying avionic principles and techniques appropriately to engineering tasks, and quoting results appropriately.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of
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	performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |  |  |
|--|--|
| <p>1 Research and identify the range of basic scientific principles and techniques relevant to avionic engineering</p>     | <p>1.1 Appropriate <i><b>sources of information</b></i> are researched, applications examined and the basic scientific principles relating to avionic engineering reported</p> <p>1.2 Basic avionic techniques and associated technologies, software and hardware required to implement scientific principles relating to avionic engineering situations are identified</p>  |
| <p>2 Select basic avionic scientific principles and techniques relevant to particular avionic engineering applications</p> | <p>2.1 The relevant basic avionic scientific techniques and principles for particular <i><b>avionic engineering</b></i> situations are selected</p> <p>2.2 The relevant basic aeronautical techniques and associated technologies, software and hardware for particular avionic engineering situations are selected</p>  |
| <p>3 Apply the relevant basic avionic scientific principles and techniques</p>   | <p>3.1 The <i><b>basic avionic scientific principles</b></i> are applied in a consistent and appropriate manner to obtain any required solution</p> <p>3.2 Appropriate calculations and coherent units are used in the solution of engineering calculations</p> <p>3.3 Significant figures are used in engineering calculations</p> <p>3.4 The basic avionic techniques and associated technologies, software and hardware are applied in a consistent and appropriate manner to obtain required solutions</p> |
| <p>4 Quote the results of the application of the basic avionic scientific principles and basic techniques</p>              | <p>4.1 An appropriate style is used to quote solutions for applications involving engineering calculations</p> <p>4.2 An appropriate style is used to quote solutions for applications not involving engineering calculations</p>  |

## Required Skills and Knowledge

Look for evidence that confirms knowledge of:

- physics for electronics:
  - units and measurements
  - magnetic force
  - vectors
  - electric fields and potential
  - electric current and resistance
  - capacitance
  - work, power and energy
- analogue electronics:
  - negative feedback amplifiers
  - differential amplifiers
  - operational amplifiers
  - amplifier frequency response
  - thermal circuits/heat exchangers
  - active filters
  - fault-finding
- digital electronics:
  - characteristics of digital systems
  - number systems
  - Boolean algebra
  - logic circuits
  - logic families
  - construction and testing techniques
  - flip flop circuits
  - analogue to digital conversion
  - digital to analogue conversion
  - timing and control
  - combinational logic circuits
- circuit theory:
  - Kirchhoff's Current and Voltage Laws
  - Thevenin's Network Theorem
  - Norton's Network Theorem
  - Superposition Network Theorem
  - inductance, capacitance and resistance (LCR) series circuit analysis
  - LCR parallel circuit analysis
  - series and parallel resonance
- electrical systems:



- DC and AC circuit design principles
  - generators and motors
  - inverters
  - power supply, transformer, rectifier, filter and regulator
  - solenoids
  - circuit protection
  - wiring cables and looms
- aerodynamics:
  - Bernoulli's Theorem
  - the atmosphere
  - aerodynamic forces (lift, drag, weight and thrust)
  - stability and control (to a level not requiring the application of calculus)
- thermodynamics – heat transfer principles (conduction, convection and radiation)
- instruments:
  - airspeed measurement
  - altitude measurement
  - attitude indication
  - measurement of quantity, flow, temperature, pressure and position
- control concepts and data communications:
  - servo and synchronous systems and components
  - data communication definitions and terminology
- communications:
  - radio transmission and modulation
  - radio reception
  - microphones, amplifiers and speakers
  - transmission lines and antennas
- pulse:
  - antennas
  - waveguides
  - transmitters/receivers
  - displays
- light, sound and vibration:
  - wave behaviour – standing vs travelling waves, transverse and longitudinal
  - light – reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet, transmission medium and engineering applications
  - sound – pitch, frequency, intensity (power), decibel scale, 'noise dose', spectrum, infrasound, audible, ultrasound, speed, natural frequency, resonance, transmission medium and engineering applications
  - vibration – sources, balancing, shaft alignment, measurement, damping and engineering applications

- appropriateness of calculations
- fundamental and derived quantities
- the procedure for carrying out dimensional analysis
- the concept of significant figures
- the uncertainty of computations based on experimental data
- the procedures for determining the significance of figures in calculations
- the procedures for estimating errors in derived quantities

Look for evidence that confirms skills in:

- selecting appropriate basic avionic scientific principles to suit specific applications
- selecting appropriate basic avionic techniques and associated technologies, software and hardware to suit specific applications
- applying basic avionic scientific principles to particular engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations
- checking the validity of equations using dimensional analysis
- applying basic avionic techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application
- quoting solutions in appropriate units, using appropriate significant figures
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used
- presenting solutions referring to the original aim of the application

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	<p>A person who demonstrates competency in this unit must be able to apply basic scientific principles and techniques in avionic engineering situations.</p> <p>This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.</p>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p>

	Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning.
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units associated with applying basic scientific principles and techniques in avionic engineering situations.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Sources of information</b>	<p>Sources of information include:</p> <ul style="list-style-type: none"> <li>• reference texts</li> <li>• manufacturer catalogues and industrial magazines</li> <li>• international aerospace organisation publications</li> <li>• websites</li> <li>• use of phone, email and fax information gathering</li> </ul>

<b>Avionic engineering</b>	<p>Avionic engineering refers to:</p> <ul style="list-style-type: none"> <li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and military applications</li> </ul>
<b>Basic avionic scientific techniques and principles</b>	<p>Candidates should apply appropriate basic techniques supported by their mathematical skills and introductory knowledge of scientific principles to design, manufacturing, commissioning and maintenance-related tasks and projects relating to:</p> <ul style="list-style-type: none"> <li>electrical systems and related wiring and components (power generation, distribution, control interfaces with hydraulic and pneumatic systems, and caution and warning systems)</li> <li>mechanical and electro-mechanical flight instruments and indication systems (quantity, pressure, temperature and position) and components</li> <li>electronic systems and components (communications, radio navigation, pulse, display, automatic flight control, flight management and engine management)</li> <li>automatic test stations, adapters and software</li> </ul> <p>The applications may require the use of one or two basic avionic scientific principles together with a fundamental mathematical calculation leading to process, resources and system choices from a limited range of options.</p> <p>Basic techniques include:</p> <ul style="list-style-type: none"> <li>basic hand and power tool operations</li> <li>machining</li> <li>fitting</li> <li>welding</li> <li>moulding</li> <li>fabricating</li> <li>wiring and programming techniques</li> </ul>

## Unit Sector(s)

Aviation maintenance

## Custom Content Section

Not applicable.

# **MEA273A Select and test avionic engineering materials**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit of competency covers selecting appropriate materials and materials and components tests for avionic engineering applications.

## **Application of the Unit**

Applications of this unit include selecting engineering materials and materials tests; sourcing materials data; ensuring appropriate performance and physical standards for avionic applications; documenting materials tests; ensuring calibration standards; and interpreting and documenting materials data sheets, as appropriate for mass production, batch production, jobbing shop and prototyping applications.

Activities may be performed as a member of a design and development or engineering support team.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |  |   |
|--|---|
| <p>1. Identify classes of materials, based on properties and materials tests relevant to avionic engineering</p>   | <p>1.1. <i>Classes of materials, based on properties</i>, required for particular <i>avionic engineering</i> applications are identified</p> <p>1.2. Material properties are related to common production and construction methods and processes</p> <p>1.3. Common characteristics, faults or flaws in materials and components or product in particular engineering applications are identified</p> <p>1.4. Test methods for materials and components or product in particular engineering applications are identified</p> <p>1.5. Specific industrial test standards/codes, calibration requirements, regulations and authorities related to selection of materials and products for particular engineering applications are identified</p> <p>1.6. The role of <i>Australia's national measurement system</i> is investigated</p> |
| <p>2. Identify and use sources of information on engineering materials, materials tests and test equipment, including manufacturers' catalogues and websites</p> | <p>2.1. Appropriate <i>sources of information</i> on materials are identified and used</p> <p>2.2. Appropriate sources of information on methods of testing of properties of materials are identified and used to ensure suitability for a particular application</p> <p>2.3. Appropriate sources of information on materials, materials tests, test calibration, test certificates, regulations, standards, <i>standards councils/societies/authorities/regulatory bodies</i> are identified and used</p> <p>2.4. The use of <i>standards and codes</i> are investigated and reported on</p> <p>2.5. Appropriate sources of information on MSDS are identified and used</p>  |
| <p>3. Specify and implement materials for particular avionic engineering</p>   | <p>3.1. Methods used to test or obtain the properties of engineering materials are specified and implemented</p>  |

applications

- |  |  |
|--|--|
| <p>4. Specify and implement methods used to test or obtain the properties of engineering materials</p> | <p>4.1. <b>Tests of materials</b> are specified and implemented to ensure quality, safety or suitability for a range of applications</p> <p>4.2. <b>Traceability</b> of measurement standard is ensured</p> <p>4.3. Test sheets/certificates for appropriate materials are obtained for applications in accordance with organisational procedures and/or codes and regulations</p> <p>4.4. Appropriate MSDS are obtained for applications in accordance with organisational procedures and/or codes and regulations</p>  |
| <p>5. Report on and record materials design data and methods and results of materials tests</p>        | <p>5.1. Materials selections are reported and recorded against design functional requirements in accordance with organisational procedures, codes and regulations including environmental impact and sustainability assessment</p> <p>5.2. Materials tests and test sheets/certificates are reported and recorded in accordance with organisational procedures, codes and regulations</p> <p>5.3. Appropriate calibration and traceability are ensured</p> <p>5.4. Appropriate MSDS are reported and recorded for applications in accordance with organisational procedures, codes and regulations</p> |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- selecting class of materials for an application based on comparison of properties for a significant range of materials classes
- selecting class of materials for an application suitable to production and construction methods and processes
- identifying, overcoming or compensating for common characteristics, faults or flaws in materials or product
- obtaining appropriate test sheets/certificates for applications
- obtaining appropriate MSDS for application
- completing reports, records and design documentation
- addressing environmental impact and sustainability issues
- reporting, recording and filing test reports and documentation
- implementing materials tests and test sheets/certificates, test calibration and traceability
- identifying test methods for materials and components, specific industrial test standards



and regulations for particular engineering applications

- identifying test methods for faults or flaws in materials and components or product
- selecting materials following an extensive search of appropriate sources of information including manufacturer's catalogues and websites
- selecting appropriate tests from a range of possible tests, following an extensive search of appropriate sources of information including manufacturer's catalogues and websites
- satisfying applicable standards and regulations for materials and components
- sourcing materials test certificates and using the material properties information from them
- sourcing and implementing MSDS
- implementing tests correctly for materials and component faults and properties of materials
- selecting testing methods appropriate to applications

### **Required knowledge**

Look for evidence that confirms knowledge of:

- properties of materials classes
- the effect of material properties on production and construction methods and processes
- the effect of characteristics, faults or flaws in materials on product and processes
- test methods for materials and components, specific industrial test standards, regulations and authorities related to particular engineering applications
- test methods for faults or flaws in materials and components or product
- methods of accessing and using alternative information sources
- test procedures and typical applications for tests
- sources and uses of information on materials, materials tests, test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing MSDS
- identification of materials for an application based on comparison of properties of materials
- identification of test for an application based on an understanding of its ability to measure specific material or product properties
- significance of test sheets/certificates to applications
- the need for obtaining and filing test sheets/certificates
- significance of MSDS and relevance of procedures
- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test reports and documentation to applications
- significance of reporting and recording procedures
- significance of materials tests and test sheets/certificates, test calibration and traceability
- significance of MSDS to applications
- significance of reporting and recording procedures

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select and test avionic engineering materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	<p>This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.</p> <p>The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing aeronautical engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

### **Classes of materials, based on properties**

Classes of materials include:

- non-ferrous metals and alloys (copper, aluminium, zinc, lead, tin and their alloys), ferrous metals (carbon steels, alloy steels, cast irons), non-metallic composite materials, bearing materials, lubricants, non-metals (timber, ceramics, polymers and fabrics, adhesives, electrical insulation materials), thermal conductors and insulators, electrical conductors, semiconductors and insulators

Properties of materials include:

- strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation (e.g. use of plastic fillers to enhance UV resistance), adhesion (electrical, magnetic, thermal, chemical and optical), material structure and effect on properties

Other factors include:

- corrosion and corrosion protection methods
- the effect of manufacturing and construction processes on material properties
- the effect of property enhancement on design (e.g. adhesives plus sintering replacing some forging and machining of gears on shafts)

Cost includes:

- manufacture of material and source of material, typical applications and possibilities

### **Avionic engineering**

Avionic engineering refers to:

- the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace electrical, instrument, radio and electronic systems and components and related test equipment for civil and

	military applications
<b>Australia's national measurement system</b>	<p>Australia's national measurement system includes:</p> <ul style="list-style-type: none"> <li>• National Standards Commission (legal metrology)</li> <li>• Commonwealth Scientific and Research Organisation (physical standards)</li> <li>• National Association of Testing Authorities, Aust. (Laboratory accreditation)</li> <li>• Standards Australia International Ltd (AS standards specifications)</li> </ul>
<b>Sources of information</b>	<p>Sources of information includes:</p> <ul style="list-style-type: none"> <li>• reference texts, manufacturer's catalogues and industrial magazines</li> <li>• websites, use of phone, email and fax information gathering</li> </ul>
<b>Standards councils/societies/authorities/regulatory bodies</b>	<p>Standards councils/societies/authorities include:</p> <ul style="list-style-type: none"> <li>• Australian Standards</li> <li>• ASTM</li> <li>• MIL Spec.</li> <li>• ASME</li> <li>• ISO</li> </ul> <p>Regulatory bodies include:</p> <ul style="list-style-type: none"> <li>• CASA</li> <li>• ADF</li> <li>• United States FAA</li> <li>• European Joint Aviation Authority</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes include:</p> <ul style="list-style-type: none"> <li>• NDT and mechanical test standards</li> <li>• chemical test standards</li> <li>• electrical test standards</li> <li>• compliance test standards for components</li> </ul>
<b>Tests of materials</b>	<p>Tests of materials include:</p> <ul style="list-style-type: none"> <li>• destructive, including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, and peel resistance (adhesives)</li> <li>• non-destructive, including hardness, ultrasonics, X-ray, dye penetrant, eddy current, surface friction, conductivity, heat expansion, photoelastic, heat capacity refractive index, and magnetic hysteresis loop</li> </ul>
<b>Traceability</b>	Traceability ensures:

	<ul style="list-style-type: none"><li>• test calibrations can be traced back to the relevant base unit in the relevant measurement system</li></ul>
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## **Unit Sector(s)**

Engineering science

## **Competency field**

## **Co-requisite units**

Not applicable

# **MEA340A Lay out and set up aircraft systems**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit of competency is part of Diploma and Advanced Diploma training pathways. It covers the basic design and schematic layout of aircraft systems, including mechanical, hydraulic, pneumatic and fuel systems. A basic hydraulic system is set up and operated.

## **Application of the Unit**

Competency in this unit requires application of basic knowledge of aircraft system design and schematic layout, including the relative advantages of the different types of system. The candidate should be able to select appropriate types of systems for given applications and sketch the schematic layout of systems given a list of components.

A simple hydraulic system will also be set up and operated.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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### Elements and Performance Criteria

- |   |   |
|---|---|
| 1. Select and lay out schematically aircraft mechanical systems | 1.1. <b><i>Mechanical system applications</i></b> in aircraft design and their relative advantages and disadvantages compared to other system types are identified<br>1.2. Components of mechanical systems are identified<br>1.3. A mechanical system is selected for an application, the schematic layout is sketched and all components are labelled<br>1.4. Mechanical system maintenance requirements are identified   |
| 2. Select and lay out schematically aircraft hydraulic systems  | 2.1. <b><i>Hydraulic system applications</i></b> in aircraft design, their operation and their relative advantages and disadvantages compared to other system types are identified<br>2.2. Aircraft hydraulic fluids, their characteristics and handling precautions are identified<br>2.3. <b><i>Components of hydraulic systems</i></b> are identified and their operation is described in general terms<br>2.4. A hydraulic system is selected for an application, the schematic layout is sketched and all components are labelled<br>2.5. Hydraulic system maintenance requirements are identified |
| 3. Select and lay out schematically aircraft pneumatic systems  | 3.1. <b><i>Pneumatic system applications</i></b> in aircraft design, their operation and their relative advantages and disadvantages compared to other system types are identified  |

- 3.2. *Components of pneumatic systems* are identified and their operation is described in general terms
  - 3.3. A pneumatic system is selected for an application, the schematic layout is sketched and all components are labelled
  - 3.4. Pneumatic system maintenance requirements are identified
4. Select and lay out schematically aircraft fuel storage and distribution systems
  - 4.1. Typical *fuel storage and distribution systems* used in aircraft design are identified.
  - 4.2. *Components of fuel storage and distribution systems* are identified and their operation is described.
  - 4.3. A fuel storage and distribution system is selected for an application, the schematic layout is sketched and all components are labelled.
  - 4.4. Types of aircraft fuel, their characteristics and handling precautions are identified.
  - 4.5. Fuel storage and distribution system maintenance requirements are identified.
5. Set up and operate a simple hydraulic system
  - 5.1. The hydraulic system is sketched and all components are labelled
  - 5.2. *Required components* are obtained
  - 5.3. The system is assembled and operated

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- laying out a typical aircraft mechanical system
- laying out a typical aircraft hydraulic system
- laying out a typical aircraft pneumatic system
- laying out a typical fuel storage and distribution system
- setting up and operating a basic hydraulic system
- applying relevant OHS precautions, including the use of MSDS and PPE

### Required knowledge

Look for evidence that confirms knowledge of:

- fluid power principles
- plumbing identification marking
- mechanical, hydraulic and pneumatic aircraft systems, their components and maintenance



requirements

- the relative advantages and disadvantages of mechanical, hydraulic and pneumatic systems
- hydraulic fluid types, characteristics and handling precautions
- aircraft fuel storage and distribution systems and components thereof
- aircraft fuels, their characteristics and handling precautions
- OHS precautions relating to aircraft systems and their operation

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to apply basic knowledge of aircraft system design and layout for a range of aircraft applications. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, teacher's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency</p>
<b>Context of and specific resources for assessment</b>	This unit may be assessed off the job in a training environment equipped to provide exposure to the range of system types and provide for the layout, set-up and operation of basic hydraulic systems. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	

<b>Guidance information for assessment</b>	
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Application</b>	Application of this unit may relate to: <ul style="list-style-type: none"> <li>individual or team-related activities</li> </ul>
<b>Mechanical system applications</b>	Mechanical system applications may include: <ul style="list-style-type: none"> <li>flight controls</li> <li>flap operation</li> <li>nose wheel steering</li> <li>landing gear door operation</li> <li>entrance door mechanisms</li> </ul>
<b>Components of mechanical systems</b>	Components of mechanical systems may include: <ul style="list-style-type: none"> <li>cables</li> <li>chains</li> <li>sprockets</li> <li>pulleys</li> <li>fairleads</li> <li>cable tensioners</li> <li>gearboxes</li> <li>screwjacks</li> <li>rods</li> <li>universal joints</li> <li>constant velocity joints</li> <li>clutches</li> <li>bearings and bushes</li> </ul>
<b>Hydraulic system applications</b>	Hydraulic system applications may include: <ul style="list-style-type: none"> <li>flight controls</li> <li>flap and spoiler operation</li> <li>landing gear retraction and extension</li> <li>brakes (including anti-skid)</li> </ul>

	<ul style="list-style-type: none"> <li>• nose wheel steering</li> <li>• shimmy damping</li> <li>• door operation</li> </ul>
<b>Components of hydraulic systems</b>	<p>Components of hydraulic systems may include:</p> <ul style="list-style-type: none"> <li>• pumps</li> <li>• plumbing</li> <li>• valves (manual and electrically operated)</li> <li>• actuators</li> <li>• motors</li> <li>• check valves</li> <li>• pressure gauges (direct reading and electrical)</li> <li>• electrical control circuit micro switches</li> <li>• reservoirs</li> <li>• accumulators</li> <li>• filters</li> <li>• heat exchangers</li> </ul>
<b>Pneumatic system applications</b>	<p>Pneumatic system applications may include:</p> <ul style="list-style-type: none"> <li>• landing gear retraction and extension</li> <li>• pneudraulic emergency systems for landing gear extension and brakes</li> <li>• engine bleed air</li> <li>• engine starting</li> <li>• anti-icing</li> <li>• de-icing</li> <li>• pressurisation</li> <li>• air cycle air conditioning</li> </ul>
<b>Components of pneumatic systems</b>	<p>Components of pneumatic systems may include:</p> <ul style="list-style-type: none"> <li>• pre-coolers</li> <li>• pressure regulator and shutoff valves</li> <li>• temperature modulating valve</li> <li>• check valves</li> <li>• over-pressure valves</li> <li>• temperature regulating valves</li> <li>• underloading valves</li> <li>• shuttle valves</li> <li>• back pressure valves</li> <li>• outflow valves</li> <li>• moisture separators</li> <li>• chemical driers</li> <li>• filters</li> </ul>

	<ul style="list-style-type: none"> <li>• mechanical compressors</li> <li>• compressed air bottles</li> <li>• de-icing boots</li> <li>• ducting</li> </ul>
<b>Components of fuel storage and distribution systems</b>	<p>Components of fuel storage and distribution systems may include:</p> <ul style="list-style-type: none"> <li>• integral fuel cells</li> <li>• rigid and flexible fuel cells</li> <li>• external fuel tanks</li> <li>• rigid and flexible plumbing and couplings</li> <li>• manifolds</li> <li>• selector valves</li> <li>• anti-surge valves</li> <li>• anti-gravity valves</li> <li>• fuel quantity indication</li> <li>• fuel flow indication</li> <li>• boost pumps</li> <li>• transfer pumps</li> <li>• filters</li> <li>• strainers</li> <li>• fuel heaters</li> </ul>
<b>Required components</b>	<p>Required components may include:</p> <ul style="list-style-type: none"> <li>• hydraulic rig</li> <li>• manual selector valve</li> <li>• filter</li> <li>• accumulator</li> <li>• check valve</li> <li>• linear actuators</li> <li>• rigid and flexible plumbing</li> </ul>

**Unit Sector(s)**

Aeronautical engineering

**Competency field****Co-requisite units**

Not applicable



## **MEA341A Apply basic aircraft design characteristics**

### **Modification History**

Minor formatting and editorial changes made. Prerequisite unit version codes updated.

### **Unit Descriptor**

This unit of competency is part of Diploma and Advanced Diploma training pathways. It covers the aerodynamic shape and structure of aircraft.

### **Application of the Unit**

This unit requires application of basic knowledge of aerodynamic shape and structural methods.

Applications include aeroplanes and rotary wing aircraft

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |   |   |
|---|---|
| 1. Research and evaluate aeroplane aerodynamic shape      | 1.1. <b><i>Common wing plan forms</i></b> are identified and relative advantages and disadvantages are evaluated<br>1.2. <b><i>Common wing configurations</i></b> are identified and relative advantages and disadvantages are identified<br>1.3. Aerofoil characteristics are discussed in terms of aircraft performance<br>1.4. Aeroplane stability and control is discussed in terms of aerodynamic design<br>1.5. Types of primary and secondary flight control surfaces are identified and control balancing is discussed<br>1.6. Types of lift augmentation device are identified and compared<br>1.7. Factors that affect an aircraft in subsonic and high speed flight are identified |
| 2. Research and evaluate rotary wing aerodynamic design   | 2.1. <b><i>Common rotor configurations</i></b> are identified and their aerodynamic characteristics discussed<br>2.2. Rotary wing aircraft control and stability are discussed  |
| 3. Research and evaluate basic aircraft structural design | 3.1. The loads acting on an aircraft structure are identified<br>3.2. The methods of construction of airframes and power plant support structures are identified and compared<br>3.3. The materials of construction commonly used in aircraft structures are identified and their relative advantages and disadvantages are discussed<br>3.4. Fabrication methods commonly used in aircraft structure are identified and discussed<br>3.5. Maintenance requirements for aircraft structure are identified   |

- |   |   |
|---|---|
| 4. Research and evaluate basic landing gear design and construction | 4.1. The <b><i>configurations of landing gear</i></b> are identified and discussed in terms of relative advantages and disadvantages<br>4.2. The relative benefits of fixed and retractable landing gear are identified and discussed<br>4.3. Construction materials used in landing gear components are identified and discussed |
| 5. Apply basic aircraft design characteristics                      | 5.1. Given required aircraft use and performance characteristics, an appropriate aerodynamic shape is determined<br>5.2. An appropriate method of construction, materials of construction and fabrication method are proposed<br>5.3. An appropriate landing gear configuration is proposed                                       |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- applying basic aircraft design characteristics

### Required knowledge

Look for evidence that confirms knowledge of:

- theory of flight, including rotary wing
- loads acting on aircraft structures and structural fatigue, including rotary wing
- aircraft design characteristics, including rotary wing
- types of aircraft structure
- methods of aircraft construction
- materials of construction
- structural maintenance requirements
- use of NDT in structural maintenance
- basic landing gear design characteristics
- use of ultra high strength steels in landing gear design and related maintenance requirements

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment



Guidelines for the Training Package.	
<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to identify and apply basic aircraft design characteristics. Competency in this unit cannot be claimed until all prerequisites have been satisfied.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, teacher's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.</p>
<b>Context of and specific resources for assessment</b>	This unit may be assessed off the job in a training environment equipped to provide exposure to the relevant aircraft design characteristics and to theory of flight. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

### Application

Application of this unit may relate to:

	<ul style="list-style-type: none"> <li>• individual or team-related activities</li> </ul>
<b>Common wing plan forms</b>	<p>Common wing plan forms may include:</p> <ul style="list-style-type: none"> <li>• straight</li> <li>• tapered</li> <li>• swept</li> <li>• delta</li> <li>• variable geometry</li> <li>• canard</li> </ul>
<b>Common wing configurations</b>	<p>Common wing configurations may include:</p> <ul style="list-style-type: none"> <li>• mid-wing</li> <li>• low wing</li> <li>• high wing</li> </ul>
<b>Common rotor configurations</b>	<p>Common rotor configurations may include:</p> <ul style="list-style-type: none"> <li>• main rotor and tail rotor</li> <li>• two main rotors</li> <li>• two blade main rotor</li> <li>• multiple blade main rotor</li> <li>• hinged main rotor blades</li> <li>• rigid rotor</li> </ul>
<b>Configurations of landing gear</b>	<p>Configurations of landing gear may include:</p> <ul style="list-style-type: none"> <li>• tricycle</li> <li>• tail wheel</li> <li>• tail skid</li> <li>• floats</li> <li>• skis</li> <li>• helicopter skids</li> <li>• helicopter wheels and brakes</li> </ul>

## Unit Sector(s)

Aeronautical engineering

## Competency field

## Co-requisite units

Not applicable



# **MEA342A Apply basic aircraft power plant design characteristics**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit of competency is part of Diploma and Advanced Diploma training pathways. It covers the basics of aircraft power plant selection and propulsion.

## **Application of the Unit**

This unit requires application of basic knowledge of propulsion and power plant selection.

Applications include aeroplanes and rotary wing aircraft, piston engines and propellers/rotors, turbo prop, gas turbines and gas turbine/rotor.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

MEA101B	Interpret occupational health and safety practices in aviation maintenance
MEA107B	Interpret and use aviation maintenance industry manuals and specifications
MEA109B	Perform basic hand skills, standard trade practices and fundamentals in aviation maintenance



Look for evidence that confirms skills in:

- applying basic power plant and propulsion system design characteristics

### Required knowledge

Look for evidence that confirms knowledge of:

- basic power plant characteristics
- basic propeller theory and characteristics
- use of NDT in power plant maintenance
- power plant maintenance requirements, including the use of engine condition monitoring

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to identify and apply basic power plant and propulsion system design characteristics. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, teacher's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

### Context of and specific resources for assessment

This unit may be assessed off the job in a training environment equipped to provide exposure to the relevant aircraft design characteristics and to theory of flight. The candidate must have access to all tools, equipment, materials and documentation required and must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials. The

	assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Application</b>	Application of this unit may relate to: <ul style="list-style-type: none"> <li>individual or team-related activities</li> </ul>
<b>Types of aeroplane and rotary wing aircraft power plant</b>	Types of aeroplane and rotary wing aircraft power plant may include: <ul style="list-style-type: none"> <li>piston engine (petrol or diesel)</li> <li>rotary</li> <li>turboprop or gas turbine and rotor</li> <li>turbofan</li> <li>turbojet</li> </ul>
<b>Types of propeller</b>	Types of propeller may include: <ul style="list-style-type: none"> <li>fixed pitch</li> <li>adjustable pitch</li> <li>constant speed</li> <li>contra-rotating</li> <li>tractor</li> <li>pusher</li> </ul>

## Unit Sector(s)

Aeronautical engineering

## **Competency field**

## **Co-requisite units**

Not applicable



## **MEA349B Apply basic scientific principles and techniques in aeronautical engineering situations**

### **Modification History**

Knowledge requirements expanded - equivalent to previous version.

### **Unit Descriptor**

This unit of competency covers applying basic scientific principles and techniques to appropriate aeronautical engineering situations.

### **Application of the Unit**

This unit requires application of basic aeronautical scientific principles and techniques as a member of a design and development team or similar in support of the design and development of aeronautical applications, or within the engineering department of an aircraft maintenance organisation.

Applications include identifying the range of basic aeronautical scientific principles and techniques relevant to aeronautical engineering, selecting aeronautical principles and techniques for particular applications, applying aeronautical principles and techniques appropriately to engineering tasks, quoting results appropriately.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |   |   |
|---|---|
| 1 Research and identify the range of basic scientific principles and techniques relevant to aeronautical engineering          | 1.1 The basic scientific principles relating to aeronautical engineering are researched and reported on from appropriate <i><b>sources of information</b></i> and examination of applications                     |
|   | 1.2 The basic aeronautical techniques and associated technologies, software and hardware required to implement scientific principles relating to <i><b>aeronautical engineering</b></i> situations are identified |
| 2 Select basic aeronautical scientific principles and techniques relevant to particular aeronautical engineering applications | 2.1 For particular <b>aeronautical engineering</b> situations, the <i><b>relevant basic aeronautical scientific techniques and principles</b></i> can be selected   |
|   | 2.2 For particular aeronautical engineering situations, the relevant basic aeronautical techniques and associated technologies, software and hardware can be selected   |
| 3 Apply the relevant basic aeronautical scientific principles and techniques appropriately                                    | 3.1 The basic aeronautical scientific principles are applied in a consistent and appropriate manner to obtain any required solution   |
|   | 3.2 Appropriate calculations and coherent units are used in the solution of engineering calculations  |
|   | 3.3 Significant figures are used in engineering calculations  |
|   | 3.4 The basic aeronautical techniques and associated technologies, software and hardware are applied in a consistent and appropriate manner to obtain required solutions  |
| 4 Quote the results of the application of the basic aeronautical scientific principles and basic techniques correctly         | 4.1 For applications involving engineering calculations, the solution is quoted in an appropriate style   |
|   | 4.2 For applications not involving engineering calculations, the solution is quoted in an appropriate style   |

## Required Skills and Knowledge

Look for evidence that confirms knowledge of:

- basic aeronautical scientific principles including:
  - statics – complete tasks requiring analysis and application of:
    - forces and moments of forces
    - systems of concurrent and non-concurrent forces
    - dry sliding friction
  - dynamics – complete tasks requiring analysis and application of:
    - Newton's Laws
    - kinematics and kinetics of uniformly accelerated linear motion
    - kinematics and kinetics of uniformly accelerated rotation
    - curvilinear motion and centrifugal force
    - work, energy, power and torque
    - mechanical advantage and efficiency
  - strength of materials:
    - axial tension and compression
    - direct shear
    - bolted, riveted, bonded and welded connections
    - shear in beams
    - bending stresses and bending deflections (by standard formulas only)
    - torsion
  - aerodynamics:
    - Bernoulli's Theorem
    - the atmosphere
    - aerodynamic forces (lift, drag, weight and thrust)
    - stability and control (to a level not requiring the application of calculus)
    - airscrews and propulsion (to a level not requiring the application of calculus)
    - aircraft performance (to a level not requiring the application of calculus)
  - fluid mechanics:
    - properties of fluids including mineral and synthetic hydraulic fluids
    - fluid statics, Archimedes' Principle and Pascal's Principle
    - fluid flow – continuity and energy conservation
    - fluid power – pumps
  - thermodynamics:
    - heat transfer principles (conduction, convection and radiation)
    - perfect gas laws
    - kinetic theory of gases
    - laws of thermodynamics
- control concepts including closed and open loop control

- electricity and electronics:
  - basic electrical concepts
  - Ohm's Law
  - Kirchhoff's Current and Voltage Laws
  - basic DC circuits
  - basic power supply, transformer, rectifier, filter and regulator
  - PLC concepts – I/O, timing, counting, programming
  - electronic devices (discrete) – resistors, diodes, capacitors, inductors, transistors and rectifiers
  - microprocessor concepts
- light, sound and vibration:
  - wave behaviour – standing vs travelling waves, transverse and longitudinal
  - light – reflection, absorption, refraction, diffraction, spectrum, infrared, visible, ultraviolet, transmission medium and engineering applications
  - sound – pitch, frequency, intensity (power), decibel scale, 'noise dose', spectrum, infrasound, audible, ultrasound, speed, natural frequency, resonance, transmission medium and engineering applications
  - vibration – sources, balancing, shaft alignment, measurement, damping and engineering applications
- basic aeronautical techniques and related technologies, software and hardware associated with implementing scientific principles in mechanical engineering solutions
- the applicability and limitations of basic aeronautical scientific principles
- the applicability and limitations of basic aeronautical techniques and associated technologies, software and hardware
- appropriateness of calculations
- fundamental and derived quantities
- common systems of units
- the procedure for converting between systems of units
- common prefixes used with units and their values
- the procedure for carrying out dimensional analysis
- the concept of significant figures
- the uncertainty of computations based on experimental data
- the procedures for determining the significance of figures in calculations
- the procedures for estimating errors in derived quantities

Look for evidence that confirms skills in:

- selecting appropriate basic aeronautical scientific principles to suit specific applications
- selecting appropriate basic aeronautical techniques and associated technologies, software and hardware to suit specific applications
- applying basic aeronautical scientific principles to particular engineering situations
- applying and manipulating appropriate formulas for applications involving engineering calculations
- applying appropriate calculations to engineering situations

- checking the validity of equations is using dimensional analysis
- applying basic aeronautical techniques and associated technologies, software and hardware in a manner appropriate to the application and identified scientific principles
- referring solutions to the original aim of the application
- quoting solutions in appropriate units, using appropriate significant figures
- quoting limitations of solutions, due to assumptions, scientific principles and techniques used
- presenting solutions referring to the original aim of the application

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Overview of assessment

A person who demonstrates competency in this unit must be able to apply basic scientific principles and techniques in aeronautical engineering situations.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency.

### Context of and specific resources for assessment

This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.

The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace

	procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with applying basic scientific principles and techniques in aeronautical engineering situations or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Sources of information</b>	Sources of information include: <ul style="list-style-type: none"> <li>reference texts</li> <li>manufacturer catalogues and industrial magazines</li> <li>international aerospace organisation publications</li> <li>websites</li> <li>use of phone, email and fax information gathering</li> </ul>
<b>Aeronautical engineering</b>	Aeronautical engineering refers to: <ul style="list-style-type: none"> <li>the engineering discipline concerned with the conceptual development, research, design, manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications</li> </ul>
<b>Relevant basic aeronautical scientific techniques and principles</b>	Candidates should apply appropriate basic techniques supported by their mathematical skills and introductory knowledge of scientific principles to design, manufacturing, commissioning and maintenance related tasks and projects relating to metal and composite structure, aerodynamic loads, stability, control and performance, mechanical systems and related

	<p>components, hydraulic systems and related components, pneumatic systems and related components, air cycle air conditioning and pressurisation systems and related components, power plant systems and components, and the application and interfacing of electrical and electronic system control.</p> <p>The applications may require the use of one or two basic aeronautical scientific principles together with a fundamental mathematical calculation leading to process, resources and system choices from a limited range of options.</p> <p>Basic techniques include:</p> <ul style="list-style-type: none"><li>• basic hand and power tool operations</li><li>• machining</li><li>• fitting</li><li>• welding</li><li>• moulding</li><li>• fabricating</li><li>• wiring and programming techniques</li></ul>
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## Unit Sector(s)

Engineering science

## Custom Content Section

Not applicable.

# **MEA350A Select and test aeronautical engineering materials**

## **Modification History**

Minor formatting and editorial changes made.

## **Unit Descriptor**

This unit of competency covers selecting appropriate materials and materials and components tests for aeronautical engineering applications.

## **Application of the Unit**

Applications of this unit include selecting engineering materials and materials tests, sourcing materials data; ensuring appropriate performance and physical standards for aeronautical applications; documenting materials tests, ensured calibration standards; interpreting and documenting materials data sheets as appropriate for mass production, batch production, jobbing shop, and prototyping applications.

Activities may be performed as a member of a design and development or engineering support team.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable

## **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

- |  |  |
|--|--|
| <p>1. Identify classes of materials, based on properties and materials tests relevant to aeronautical engineering</p>  | <p>1.1. <i>Classes of materials</i> are identified, <i>based on properties</i>, required for particular <i>aeronautical engineering</i> applications</p> <p>1.2. Relate material properties are related to common production and construction methods and processes</p> <p>1.3. Common characteristics, faults or flaws in materials and components or product are identified in particular engineering applications</p> <p>1.4. Test methods for materials and components or product are identified in particular engineering applications</p> <p>1.5. Specific industrial test standards/codes, calibration requirements, regulations and authorities related to selection of materials and products are identified for particular engineering applications</p> <p>1.6. The role of <i>Australia's national measurement system</i> is investigated</p> |
| <p>2. Identify and use sources of information on engineering materials, materials tests and test equipment, including manufacturers' catalogues and websites</p> | <p>2.1. Appropriate <i>sources of information</i> on materials are identified and used</p> <p>2.2. Appropriate sources of information on methods of testing of properties of materials are identified and used to ensure suitability for a particular application</p> <p>2.3. Appropriate sources of information on materials, materials tests, test calibration, test certificates, regulations, standards, <i>standards councils/societies/authorities/regulatory bodies</i> are identified and used</p> <p>2.4. The use of <i>standards and codes</i> are investigated and reported on</p> <p>2.5. Appropriate sources of information on MSDS are identified and used</p>   |
| <p>3. Specify and implement materials for particular aeronautical engineering</p>  | <p>3.1. Materials for particular applications are specified and implemented</p>  |

applications.

- |  |  |
|--|--|
| <p>4. Specify and implement methods used to test or obtain the properties of engineering materials</p> | <p>4.1. <b>Tests of materials</b> are specified and implemented to ensure quality, safety or suitability for a range of applications</p> <p>4.2. <b>Traceability</b> of measurement standard is ensured</p> <p>4.3. Test sheets/certificates for appropriate materials are obtained for applications in accordance with organisational procedures and/or codes and regulations</p> <p>4.4. Appropriate MSDS are obtained for applications in accordance with organisational procedures and/or codes and regulations</p>  |
| <p>5. Report on and record materials design data and methods and results of materials tests</p>        | <p>5.1. Materials selections are reported and recorded against design functional requirements in accordance with organisational procedures, codes and regulations, including environmental impact and sustainability assessment.</p> <p>5.2. Materials tests and test sheets/certificates are reported and recorded in accordance with organisational procedures, codes and regulations</p> <p>5.3. Appropriate calibration and traceability are ensured</p> <p>5.4. Appropriate MSDS are reported and recorded for applications in accordance with organisational procedures, codes and regulations</p> |

## Required Skills and Knowledge

### Required skills

Look for evidence that confirms skills in:

- selecting class of materials for an application based on comparison of properties for a significant range of materials classes
- selecting class of materials for an application suitable to production and construction methods and processes
- identifying, overcoming or compensating for common characteristics, faults or flaws in materials or product
- identifying test methods for materials and components, specific industrial test standards and regulations for particular engineering applications
- identifying test methods for faults or flaws in materials and components or product
- selecting materials following an extensive search of appropriate sources of information, including manufacturer's catalogues and websites
- selecting appropriate tests from a range of possible tests, following an extensive search of appropriate sources of information, including manufacturer's catalogues and websites

- satisfying applicable standards and regulations for materials and components
- sourcing materials test certificates and using the material properties information from them
- sourcing and implementing MSDS
- implementing tests correctly for materials and component faults and properties of materials
- selecting testing methods appropriate to applications
- obtaining appropriate test sheets/certificates for applications
- obtaining appropriate MSDS for application
- completing reports, records and design documentation
- addressing environmental impact and sustainability issues
- reporting, recording and filing test reports and documentation
- implementing materials tests and test sheets/certificates, test calibration and traceability

### **Required knowledge**

Look for evidence that confirms knowledge of:

- properties of materials classes
- the effect of material properties on production and construction methods and processes
- the effect of characteristics, faults or flaws in materials on product and processes
- test methods for materials and components, specific industrial test standards, regulations and authorities related to particular engineering applications
- test methods for faults or flaws in materials and components or product
- methods of accessing and using alternative information sources
- test procedures and typical applications for tests
- sources and uses of information on materials, materials tests, test certificates, regulations, standards, regulatory bodies and industrial authorities
- methods of accessing MSDS
- identification of materials for an application based on comparison of properties of materials
- identification of test for an application based on an understanding of its ability to measure specific material or product properties
- significance of test sheets/certificates to applications
- the need for obtaining and filing test sheets/certificates
- significance of MSDSs and relevance of procedures
- materials selections in relation to design functional requirements
- environmental impact and sustainability assessment
- significance of test reports and documentation to applications
- significance of reporting and recording procedures
- significance of materials tests and test sheets/certificates, test calibration and traceability
- significance of MSDS to applications
- significance of reporting and recording procedures

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to select and test aeronautical engineering materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.</p> <p>Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes, standards, manuals and reference materials.</p>
<b>Context of and specific resources for assessment</b>	This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then an appropriate simulation must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. The assessment environment should not disadvantage the candidate.
<b>Method of assessment</b>	This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with selecting and testing aeronautical engineering materials or other units requiring the exercise of the skills and knowledge covered by this unit.
<b>Guidance information for assessment</b>	

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

### **Classes of materials, based on properties**

Classes of materials include:

- non-ferrous metals and alloys (copper, aluminium, zinc, lead, tin and their alloys), ferrous metals (carbon steels, alloy steels and cast irons), non-metallic composite materials, bearing materials, lubricants, non-metals (timber, ceramics, polymers and fabrics, adhesives and electrical insulation materials), thermal conductors and insulators, electrical conductors, semiconductors and insulators

Properties of materials include:

- strength, elasticity, plasticity, malleability, toughness, brittleness, fatigue endurance, mouldability, weldability, machinability, formability, resistance to creep and stress relaxation, resistance to degradation (e.g. use of plastic fillers to enhance UV resistance), adhesion, electrical, magnetic, thermal, chemical and optical, material structure and effect on properties, and flammability of fabrics

Other factors include:

- corrosion and corrosion protection methods.
- aging of metals
- the effect of manufacturing and construction processes on material properties.
- the effect of property enhancement on design (e.g. adhesives plus sintering replacing some forging and machining of gears on shafts)
- lay-up methods for composite structures.

Cost includes:

- manufacture of material and source of material, typical applications and possibilities

### **Aeronautical engineering**

Aeronautical engineering refers to:

- the engineering discipline concerned with the conceptual development, research, design,

	manufacture, implementation, installation, commissioning and maintenance of aerospace mechanical, hydraulic, pneumatic, fuel and fire products, processes, systems or services for civil and military applications
<b>Australia's national measurement system</b>	<p>Australia's national measurement systems includes:</p> <ul style="list-style-type: none"> <li>• National Standards Commission (legal metrology)</li> <li>• Commonwealth Scientific and Research Organisation (physical standards)</li> <li>• National Association of Testing Authorities, Aust. (Laboratory accreditation)</li> <li>• Standards Australia International Ltd (AS standards specifications)</li> </ul>
<b>Standards councils/ societies/ authorities/regulatory bodies</b>	<p>Standards councils/societies/authorities/regulatory bodies include:</p> <ul style="list-style-type: none"> <li>• Australian Standards Council</li> <li>• ASTM</li> <li>• MIL Spec</li> <li>• ASME</li> <li>• ISO</li> </ul> <p>Regulatory bodies include:</p> <ul style="list-style-type: none"> <li>• CASA</li> <li>• ADF</li> <li>• United States Federal Aviation Authority,</li> <li>• European Joint Aviation Authority</li> </ul>
<b>Standards and codes</b>	<p>Standards and codes include:</p> <ul style="list-style-type: none"> <li>• NDT and mechanical test standards</li> <li>• chemical test standards</li> <li>• electrical test standards</li> <li>• compliance test standards for components</li> </ul>
<b>Tests of materials</b>	<p>Tests of materials include:</p> <ul style="list-style-type: none"> <li>• destructive, including tensile, compression, impact, hardness, fatigue, corrosion, stress relaxation and creep, and peel resistance (adhesives)</li> <li>• non-destructive, including hardness, ultrasonics, X-ray, dye penetrant, eddy current, surface friction, conductivity, heat expansion, photoelastic, heat capacity refractive index, magnetic hysteresis loop</li> </ul>
<b>Traceability</b>	Traceability ensures test calibrations can be traced back to the relevant base unit in the relevant measurement system

## **Unit Sector(s)**

Engineering science

## **Competency field**

## **Co-requisite units**

Not applicable

# **MEMPE001A Use engineering workshop machines**

## **Modification History**

New unit - Release 1

## **Unit Descriptor**

This unit of competency involves setting up and machining components using lathes and other machines, such as milling machines, cut off saws, pedestal grinders and fixed position drilling machines. Tooling might need to be re-sharpened but not ground up from a blank.

The settings for the machines will be calculated by the learner from given formulas, surface speeds and feed rates.

## **Application of the Unit**

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit should be integrated with the work in the project unit, *MEMPE006A Undertake a basic engineering project*, and skills developed when required by the project.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                              |   |
|---|------------------------------|---|
| 1 | Prepare a job plan           | 1.1 Identify job requirements from drawings or <b><i>other relevant materials</i></b> in consultation with an instructor/teacher/trainer<br><br>1.2 Identify <b><i>appropriate machines</i></b> in accordance with job requirements<br><br>1.3 Identify appropriate tooling in accordance with job requirements<br><br>1.4 Calculate cutting speeds and feeds<br><br>1.5 Prepare a job/project plan showing machines, tooling, cutting speeds and feeds and an appropriate sequence of operations<br><br>1.6 Confirm plan with instructor |
| 2 | Prepare for machining        | 2.1 Obtain appropriate tooling and materials<br>2.2 Set up tools and materials as required<br>2.3 Set speeds and feeds  |
| 3 | Perform machining operations | 3.1 Use and wear appropriate personal protective equipment<br>3.2 Follow safe machining practices<br>3.3 Machine materials to job requirements<br>3.4 Use <b><i>measuring equipment</i></b> as required   |

		3.5	Store completed work in a manner which will prevent/minimise potential damage
4	Complete work requirements	4.1	Clear work area of waste and clean according to requirements
		4.2	Maintain and/or store machines, tools and equipment according to instructions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing a job plan
- preparing for machining
- performing machining
- calculating speeds and feeds
- using measuring equipment as required
- appropriately cleaning and storing of equipment
- applying safe working practices
- using and applying personal protective equipment

### Required knowledge

Required knowledge includes:

- safe machine operation procedures
- material and equipment preparation requirements
- basic marking out techniques
- use and care of measuring tools
- types of machines for cutting, grinding, drilling, turning and milling
- work and tool holding methods for each machine
- safe working practices
- use and application of personal protective equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare materials and use engineering workshop machines to produce engineering components.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can: <ul style="list-style-type: none"> <li>• work safely</li> <li>• prepare job plans</li> <li>• prepare for machining</li> <li>• perform machining</li> <li>• calculate speeds and feeds</li> <li>• use measuring equipment as required</li> <li>• clean and store equipment as instructed.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful use of a lathe and other relevant workshop machines.</li> <li>• The skills covered by this unit would usually be demonstrated by an individual working alone under direct supervision.</li> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with using workshop machines.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> </ul>

	<ul style="list-style-type: none"><li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment should be in conjunction with assessment of the project unit and other units integrated into the project.</li></ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Other relevant materials</b>	Other relevant materials may include but are not limited to: <ul style="list-style-type: none"><li>• drawings</li><li>• sketches</li><li>• job instructions</li><li>• schematics</li><li>• diagrams</li><li>• technical manuals</li></ul>
<b>Appropriate machines</b>	Appropriate machines may include but are not limited to: <ul style="list-style-type: none"><li>• milling machines</li><li>• cut off saws</li><li>• pedestal grinders</li><li>• fixed position drilling machines</li><li>• computer controlled machines</li></ul>

<b>Measuring equipment</b>	Measuring equipment may include but is not limited to: <ul style="list-style-type: none"><li>• micrometers</li><li>• vernier scaled measuring devices</li><li>• rules</li><li>• calipers</li><li>• gauges</li></ul>

## Unit Sector(s)

**Competency field** Pre-employment

**Unit sector**

## Custom Content Section

Not applicable.

## MEMPE002A Use electric welding machines

### Modification History

New unit - Release 1

### Unit Descriptor

The unit of competency covers the use of manual metal arc, gas metal arc and gas tungsten arc welding machines depending on their availability in the learning institution.

The welding is not required to meet any Australian Standard. Fillet and butt welds would typically be performed on low carbon/mild steels and aluminium if required. The basic settings for the welding machine and the welding materials will be supplied to the learner.

### Application of the Unit

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit should be integrated with the work in the project unit, *MEMPE006A Undertake a basic engineering project*, and skills developed when required by the project.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify weld requirements	1.1	Identify <b><i>weld requirements</i></b> in consultation with an instructor/teacher/trainer
		1.2	Identify which <b><i>type of welding</i></b> is suitable for the job
		1.3	Identify location of welds in accordance with job requirements
		1.4	Confirm weld locations with instructor
2	Prepare for welding	2.1	Clean and prepare low and mild carbon steel or similar ready for welding
		2.2	Set up welding equipment according to given instructions
3	Perform welding	3.1	Use and wear appropriate personal protective equipment
		3.2	Follow safe welding practices
		3.3	Weld materials to job requirements
		3.4	Clean welds safely
		3.5	Store completed work as instructed
4	Complete work requirements	4.1	Clear work area of waste and clean according to requirements
		4.2	Maintain and/or store machines, tools and equipment

according to instructions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing materials
- setting welding equipment according to given instructions
- using electric welding machines to weld metal pieces together
- reading and interpreting routine information on written job instructions
- using measuring skills as required
- applying safe working and welding practices
- using and applying personal protective equipment

### Required knowledge

Required knowledge includes:

- safe machine operation procedures
- material and equipment preparation requirements
- basic marking out techniques
- use and care of measuring tools
- behaviour of metals under heat
- welding processes and properties
- post-welding treatments
- safe working and welding practices
- use and application of personal protective equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

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<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare welding materials and equipment and weld metal materials.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can:</p> <ul style="list-style-type: none"><li>• work safely</li><li>• prepare materials</li><li>• set welding equipment according to given instructions</li><li>• use electric welding machines to weld metal pieces together</li><li>• read and interpret routine information on written job instructions</li><li>• use measuring equipment as required</li><li>• clean and store equipment as instructed.</li></ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"><li>• This unit must be assessed in a learning institution.</li><li>• Assessment must cover the successful use of one or more electric welding machines.</li><li>• The skills covered by this unit would be demonstrated by an individual working alone under direct supervision.</li><li>• The assessment environment should not disadvantage the candidate.</li><li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with using electric welding machines.</li></ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"><li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li><li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li><li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li><li>• Assessment should be in conjunction with</li></ul>

	assessment of the project unit and other units integrated into the project.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Weld requirements</b>	Weld requirements may be identified from, but are not limited to: <ul style="list-style-type: none"><li>• drawings</li><li>• sketches</li><li>• job instructions</li><li>• schematics</li><li>• diagrams</li><li>• technical manuals</li></ul>
<b>Type of welding</b>	Welding involves the use of electric welding machines and may include any or all of the following welding processes: <ul style="list-style-type: none"><li>• manual metal arc welding</li><li>• gas metal arc welding</li><li>• tungsten metal arc welding</li></ul>

## **Unit Sector(s)**

**Competency field** Pre-employment

**Unit sector**

## **Custom Content Section**

Not applicable.

## MEMPE003A Use oxy-acetylene and soldering equipment

### Modification History

New unit - Release 1

### Unit Descriptor

This unit of competency covers the use of an oxy-acetylene torch to cut low carbon/mild steels and to heat the steel to enable bending. It also covers basic silver soldering and brazing.

The settings for the oxy-acetylene and heating equipment as well as the materials will be supplied to the learner. No assembly of the oxy-acetylene hoses and gauges will be required.

### Application of the Unit

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit should be integrated with the work in the project unit *MEMPE006A Undertake a basic engineering project*, and skills developed when required by the project.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify cutting and heating requirements	1.1	Identify cutting and <i>heating requirements</i> in consultation with an instructor/teacher/trainer
		1.2	Identify location of heat application in accordance with job requirements
		1.3	Confirm application of heat locations with instructor
2	Perform cutting and heating	2.1	Use and wear appropriate personal protective equipment
		2.2	Start equipment following given instructions
		2.3	Set equipment following given instructions
		2.4	Cut and heat materials to pre-determined specifications
		2.5	Follow safe working practices
		2.6	Store and/or dispose of work materials as instructed
3	Identify silver soldering/brazing requirements	3.1	Identify silver soldering/brazing requirements in consultation with an instructor/teacher/trainer
		3.2	Identify location of silver soldering/brazing in accordance with job requirements
		3.3	Confirm silver soldering/brazing locations with instructor
4	Prepare for silver	4.1	Clean and prepare low and mild carbon steel and copper,

	soldering/brazing		or similar, ready for silver soldering and brazing
		4.2	Set up heating equipment according to given instructions
5	Perform silver soldering and brazing	5.1	Use and wear appropriate personal protective equipment.
		5.2	Apply <i>safe silver soldering and brazing practices</i>
		5.3	Silver solder and braze materials to job requirements
		5.4	Clean welds safely
		5.5	Store and/or dispose of work materials as instructed
6	Complete work requirements	6.1	Clear work area of waste and clean according to requirements
		6.2	Maintain and/or store machines, tools and equipment according to instructions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing materials
- setting up oxy-acetylene/heating equipment according to given instructions
- using oxy-acetylene equipment to heat, braze and cut metal
- silver soldering
- reading and interpreting routine information on written job instructions
- using measuring skills as required
- applying safe working practices
- using and applying personal protective equipment

## Required knowledge

Required knowledge includes:

- safe equipment operation practices
- material and equipment preparation requirements
- basic marking out techniques
- use and care of measuring tools
- heating and cutting processes
- post-heating and cutting treatments
- safe working practices
- use and application of personal protective equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare materials and use oxy-acetylene and soldering equipment as instructed.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can <ul style="list-style-type: none"> <li>• work safely</li> <li>• prepare materials</li> <li>• set oxy-acetylene/heating equipment according to given instructions</li> <li>• use oxy-acetylene equipment to heat, braze and cut metal</li> <li>• silver solder</li> <li>• read and interpret routine information on written job instructions</li> <li>• use measuring equipment as required</li> <li>• clean and store equipment as instructed.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful use of oxy-acetylene and soldering equipment.</li> <li>• The skills covered by this unit would be demonstrated by an individual working alone</li> </ul>

	<p>under direct supervision.</p> <ul style="list-style-type: none"> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with using oxy-acetylene and soldering equipment.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment should be in conjunction with assessment of the project unit and other units integrated into the project.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Heating requirements</b>	Heating requirements may include the use of but are not limited heating equipment such as:
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	<ul style="list-style-type: none"><li>• oxy-acetylene equipment</li><li>• LP gas equipment</li><li>• electrically heated equipment/soldering irons</li></ul>
<b>Safe silver soldering and brazing practices</b>	Safe silver soldering and brazing practices include but are not limited to ensuring the solder being used has no known health risks.

## Unit Sector(s)

**Competency field** Pre-employment

**Unit sector**

## Custom Content Section

Not applicable.

## MEMPE004A Use fabrication equipment

### Modification History

New unit - Release 1

### Unit Descriptor

This unit of competency involves setting up and using fabrication equipment to make engineered components.

### Application of the Unit

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit should be integrated with the work in the project unit, *MEMPE006A Undertake a basic engineering project*, and skills developed when required by the project.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of      Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used,

a unit of competency. further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                                  |     |  |
|---|----------------------------------|-----|--|
| 1 | Prepare a job plan               | 1.1 | Identify job requirements from drawings and <i>other relevant documents</i> in consultation with an instructor/teacher/trainer |
|   |                                  | 1.2 | Identify appropriate machines/equipment in accordance with job requirements  |
|   |                                  | 1.3 | Prepare a job/project plan showing machines, tooling, cutting speeds and feeds and an appropriate sequence of operations       |
|   |                                  | 1.4 | Confirm plan with instructor   |
| 2 | Fabricate components as required | 2.1 | Use and wear appropriate personal protective equipment   |
|   |                                  | 2.2 | Perform marking out and measuring as required  |
|   |                                  | 2.3 | Use <i>fabrication machinery</i> to bend, roll or shape material to requirements   |
|   |                                  | 2.4 | Check/measure work for conformance to requirements at each stage   |
|   |                                  | 2.5 | Store completed work in a manner which will prevent/minimise potential damage  |
|   |                                  | 2.6 | Work safely  |
| 3 | Complete work requirements       | 3.1 | Clear work area of waste and clean according to requirements   |
|   |                                  | 3.2 | Maintain and/or store machines, tools and equipment according to instructions  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing materials, including marking out, as required
- setting fabrication equipment according to given instructions
- using fabrication equipment to bend, roll and shape metal
- reading and interpreting routine information on written job instructions
- using measuring skills as required
- applying safe working practices
- using and applying personal protective equipment

### Required knowledge

Required knowledge includes:

- safe operation of machines/equipment
- material and equipment preparation
- basic marking out techniques
- measuring tools
- machine types for bending, rolling and shaping
- work and tool holding methods for each machine
- safe working practices
- use and application of personal protective equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to prepare materials, set up and use fabrication machinery to make engineering components.
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<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can:</p> <ul style="list-style-type: none"> <li>• work safely</li> <li>• prepare materials including any required marking out</li> <li>• set fabrication equipment according to given instructions</li> <li>• use fabrication equipment to bend, roll and shape metal</li> <li>• read and interpret routine information on written job instructions</li> <li>• use measuring equipment as required</li> <li>• clean and store equipment as instructed.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful use of fabrication equipment.</li> <li>• The skills covered by this unit would be demonstrated by an individual working alone under direct supervision.</li> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with using fabrication equipment.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment should be in conjunction with assessment of the project unit and other units integrated into the project.</li> </ul>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Other relevant materials</b>	Other relevant materials may include but are not limited to: <ul style="list-style-type: none"><li>• drawings</li><li>• sketches</li><li>• job instructions</li><li>• schematics</li><li>• diagrams</li><li>• technical manuals</li></ul>
<b>Fabrication machinery</b>	Fabrication machinery may include but is not limited to: <ul style="list-style-type: none"><li>• shapers</li><li>• benders</li><li>• rollers</li><li>• cut off machines</li><li>• guillotines</li></ul>
<b>Measuring equipment</b>	Measuring equipment may include but is not limited to: <ul style="list-style-type: none"><li>• tape measures</li><li>• vernier scaled measuring devices</li><li>• rules</li><li>• gauges</li></ul>

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**Unit Sector(s)**

**Competency field** Pre-employment

**Unit sector**

**Custom Content Section**

Not applicable.

## **MEMPE005A Develop a career plan for the engineering and manufacturing industry**

### **Modification History**

New unit - Release 1

### **Unit Descriptor**

This unit of competency is intended to provide the opportunity to research careers, and training and career path options in the manufacturing and engineering industry. It involves research into the range of activities the industry and occupational streams cover, including engineering opportunities in industries not generally considered as engineering or manufacturing. For example, maintenance people in hospitals, teachers, and so on.

### **Application of the Unit**

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used,



a unit of competency. further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Research engineering and manufacturing occupations | 1.1 | Identify <i>industries</i> involved in manufacturing and engineering   |
|   |  | 1.2 | Determine and describe the types of <i>occupations</i> in manufacturing and engineering industries                                     |
|   |  | 1.3 | Identify and list, including the requirements/methods of achieving, an appropriate qualification or qualifications for each occupation |
| 2 | Develop a career plan                              | 2.1 | Determine career paths within manufacturing and engineering  |
|   |  | 2.2 | Develop a training plan for entry into and progression through the determined career paths   |
|   |  | 2.3 | Assess and describe own skills and interests   |
|   |  | 2.4 | Develop a strategy for gaining access to an identified occupation  |
| 3 | Review plan  | 3.1 | Discuss plan with appropriate people   |
|   |  | 3.2 | Amend plan as necessary  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- researching employment opportunities in manufacturing and engineering
- developing a personal career plan
- reviewing the career plan

## Required knowledge

Required knowledge includes:

- the variety of manufacturing industries
- the variety of engineering industries
- industries that employ engineering people
- jobs/work roles in manufacturing and engineering
- types of learning institutions that support skills development in manufacturing and engineering

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to research engineering and manufacturing career options in manufacturing, engineering and related industries.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can: <ul style="list-style-type: none"> <li>• work safely</li> <li>• explore employment opportunities in manufacturing and engineering</li> <li>• develop a personal career plan</li> <li>• review the career plan</li> <li>• clean and store equipment as instructed.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful development of a career plan.</li> </ul>

	<ul style="list-style-type: none"> <li>• The skills covered by this unit would be demonstrated by an individual working alone under direct supervision.</li> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication and reporting associated with developing a career plan.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Industries</b>	Research into industries should not be limited to manufacturing and engineering. The research should look at all types of industries that employ engineering personnel with all levels of qualifications. For example, apart from
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	<p>manufacturing and engineering, and this list is not exhaustive, engineering personnel are employed in:</p> <ul style="list-style-type: none"><li>• hospitals</li><li>• mines</li><li>• power generation plants</li><li>• maintenance of road plant</li><li>• sugar mills</li><li>• oil refineries</li><li>• defense forces</li><li>• marine vessels</li><li>• railways</li><li>• wine making</li></ul>
<b>Occupations</b>	<p>Occupations may include but are not limited to:</p> <ul style="list-style-type: none"><li>• general duties</li><li>• production work</li><li>• electrical, electronic, fabrication and mechanical trades</li><li>• para-professional engineers</li><li>• engineers</li></ul>

## Unit Sector(s)

### Competency field

### Unit sector

## Custom Content Section

Not applicable.

# **MEMPE006A Undertake a basic engineering project**

## **Modification History**

New unit - Release 1

## **Unit Descriptor**

This unit of competency is intended to provide the learner with the opportunity to plan and undertake an engineering project which can be completed in an institutional environment.

Included in this unit is the opportunity to use a basic computer-aided drafting (CAD) system to produce engineering type drawings. The drawings produced have to be fit for purpose but do not necessarily need to conform to drawing standard, such as *AS 1100.101-1992 Technical drawing - General principles*.

This unit is also intended to provide the learner with the opportunity to incorporate the skills available in other units to produce a functional engineering product in an institutional environment. Skills such as welding and machining do not need to be pre-developed but can be developed in an integrated way as required throughout the project progress.

## **Application of the Unit**

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in institutional based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit should be integrated with the skills development undertaken through other units in this qualification.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Research engineering materials and components	1.1	Determine the uses of <b><i>engineering materials</i></b> , such as types and forms of metals, polymers (thermo setting and thermo plastic) and fibres
		1.2	Describe the advantages of the engineering materials when compared to each other
		1.3	Determine commonly available <b><i>shapes of metal materials</i></b> , such as sheet, plate, bar, angle iron and other common shapes
		1.4	Determine <b><i>methods used to join metal</i></b> pieces, such as, threads, pins, circlips, rivets, welding, folded joints and adhesives
		1.5	Describe the advantages of the different metal joining methods
		1.6	Determine the types of plain and anti-friction bearings, including type of materials, used in machines
		1.7	Describe the advantages and disadvantages of the different types of bearings
2	Develop a metals-based project	2.1	Research and decide on a realistic project that can be completed in the institution in the available time
		2.2	Determine the types of material required for the project

- |   |                                     |     |   |
|---|-------------------------------------|-----|---|
|   |                                     | 2.3 | Determine the amount of material and components required  |
|   |                                     | 2.4 | Gain approval for the project   |
| 3 | Determine drawing requirements      | 3.1 | Research engineering drawing practices  |
|   |                                     | 3.2 | Decide how drawings will be produced, e.g. using a CAD systems and/or hand drawing equipment, and/or freehand sketches        |
|   |                                     | 3.3 | Decide on appropriate dimensioning methods for the drawings produced  |
|   |                                     | 3.4 | Decide on methods and conventions for naming and saving new or modified drawings  |
| 4 | Create project drawings             | 4.1 | Produce drawings of the completed project using either CAD systems, hand drawing equipment or freehand sketches               |
|   |                                     | 4.2 | Produce drawings of the individual project components using either CAD systems, hand drawing equipment or freehand sketches   |
|   |                                     | 4.3 | Review drawings with teacher/instructor and peers   |
|   |                                     | 4.4 | Modify drawings as required   |
|   |                                     | 4.5 | Produce an items and materials list using the either the CAD system or other computer software                                |
| 5 | Plan the manufacture of the product | 5.1 | Determine the machines, tools and equipment required  |
|   |                                     | 5.2 | Determine the sequence of individual component manufacture and measures needed to protect manufactured components from damage |
|   |                                     | 5.3 | Develop a plan for the assembly of the project  |
|   |                                     | 5.4 | Get advice and approval for the project and plan  |

6	Manufacture the product	6.1	Use and wear appropriate personal protective equipment
		6.2	Follow safe working practices and procedures
		6.3	Manufacture and store components and acquire stock components according to the developed plan
		6.4	Assemble product according to the developed and approved plan
		6.5	Check for conformance to requirements throughout the manufacture and assembly process
		6.6	Submit the project for final endorsement
7	Complete work requirements	7.1	Clear work area of waste and clean according to requirements
		7.2	Maintain and/or store machines, tools and equipment according to instructions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- working safely
- selecting engineering materials for a project
- selecting engineering components for a project
- determining appropriate joining methods for engineering materials and components
- researching and evaluating engineering projects for their appropriateness in an educational institution
- producing drawings of an assembled project and its components
- planning the manufacture of an engineering project, including all necessary calculations
- producing components following created drawings
- assembling project
- tidying/cleaning work area as appropriate



- returning tools, equipment and project items to designated storage areas and/or conditions
- using and applying personal protective equipment

## Required knowledge

Required knowledge includes:

- safe working practices in an engineering workshop
- sources of information on engineering materials and components
- sources of information on engineering projects
- engineering drawing practices
- methods of joining metals
- the need for drawings that others can follow

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to research, plan and make an engineering project in a learning institution.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors must be satisfied that the candidate can</p> <ul style="list-style-type: none"><li>• work safely</li><li>• select engineering materials for a project</li><li>• select engineering components for a project</li><li>• determine appropriate joining methods for engineering materials and components</li><li>• research and evaluate engineering projects for their appropriateness in an educational institution</li><li>• produce drawings of an assembled project and its components</li><li>• plan the manufacture of an engineering project, including all necessary calculations</li><li>• produce components following created drawings</li><li>• assemble project</li><li>• clean and store equipment as instructed.</li></ul>

<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful manufacture of a project.</li> <li>• The skills covered by this unit would be demonstrated by an individual working alone or in a team and under direct supervision.</li> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, equipment operation, recording and reporting associated with making the project.</li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment should be in conjunction with assessment of the all skills and units integrated into the project.</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. **Italicised** wording, if used in the performance criteria, is detailed below. Essential

operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Engineering materials</b>	Engineering materials may include but are not limited to: <ul style="list-style-type: none"><li>• types of metal</li><li>• thermo setting and thermo plastic polymers</li><li>• fibre glass</li><li>• carbon fibre</li></ul>
<b>Shapes of metal materials</b>	Metal material shapes may include but are not limited to: <ul style="list-style-type: none"><li>• sheet</li><li>• plate</li><li>• bar</li><li>• angle iron</li><li>• extruded forms</li><li>• channel</li><li>• beams</li></ul>
<b>Methods used to join metal</b>	Methods used to join metal may include but are not limited to: <ul style="list-style-type: none"><li>• threaded fasteners</li><li>• pins</li><li>• circlips</li><li>• rivets</li><li>• welding</li><li>• folded joints</li><li>• adhesives</li></ul>

## Unit Sector(s)

### Competency field

### Unit sector

## Custom Content Section

Not applicable.

# MEMPE007A Pull apart and re-assemble engineering mechanisms

## Modification History

New unit - Release 1

## Unit Descriptor

This unit of competency involves pulling apart engineering mechanisms, such as small compressors, small two and four stroke engines, industrial gear boxes, mechanical winches, or any mechanism made up of a number of components, determining the types and quantity of components in the mechanism, and re-assembling the mechanism.

The mechanisms must have an associated maintenance/instruction manual for the learner to reference.

## Application of the Unit

This unit is designed for use in a pre-employment skills introduction program and is suitable for use in conjunction with institutional-based vocational programs. Skills development will take place under direct supervision.

This unit is not to be used in a traineeship or apprenticeship training program or associated qualifications. It is only to be used in pre-employment programs and carries no credit towards apprenticeship/trade and other qualification types in manufacturing and engineering.

This unit could be integrated with the work in the project unit, *MEMPE006A Undertake a basic engineering project*, and skills developed when required by the project. It would certainly be integrated with the development of skills for the unit *MEM18001B Use hand tools* and could be used to enhance the research learning about components in the project unit.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency. Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                          |   |
|---|--------------------------|---|
| 1 | Prepare a job plan       | 1.1 Identify job requirements by inspecting the mechanism, <b><i>associated</i></b> manual and other relevant materials, in consultation with an instructor/teacher/trainer<br><br>1.2 Identify required tools and machines in accordance with job requirements<br><br>1.3 Prepare a job/project plan showing tools and machines to be used and an appropriate sequence of operations<br><br>1.4 Confirm plan with instructor |
| 2 | Pull the mechanism apart | 2.1 Use and wear appropriate personal protective equipment<br>2.2 Clear the work area<br>2.3 Obtain appropriate tools and equipment<br>2.4 Follow safe working practices<br>2.5 Pull the mechanism apart marking components to aid correct re-assembly<br>2.6 Identify and record the name and quantity of each component<br>2.7 Use <b><i>measuring equipment</i></b> as required  |

3	Re-assemble the mechanism	3.1	Use and wear appropriate personal protective equipment
		3.2	Follow safe working practices
		3.3	Re-assemble the mechanism following markings and associated manual
		3.4	Use measuring equipment as required
4	Complete work requirements	4.1	Clear work area of waste and clean according to requirements
		4.2	Maintain and/or store machines, tools and equipment according to instructions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- preparing a job plan
- preparing for disassembly
- performing disassembly
- identifying components
- performing re-assembly
- using measuring equipment as required
- cleaning and storing equipment appropriately
- applying safe working practices
- using and applying personal protective equipment

### Required knowledge

Required knowledge includes:

- safe working procedures
- non-destructive methods for marking components

- basic disassembly techniques
- use and care of tools
- types of tools and machines used to pull components apart
- safe working practices
- use and application of personal protective equipment

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria required skills and knowledge range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	A person who demonstrates competency in this unit must be able to safely use engineering tools and equipment to pull engineering mechanisms apart, record information about the components and put the mechanism back together again.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	Assessors must be satisfied that the candidate can <ul style="list-style-type: none"> <li>• work safely</li> <li>• prepare job plans</li> <li>• identify and follow a sequence of work</li> <li>• prepare for pulling a mechanism apart</li> <li>• pull a mechanism apart</li> <li>• record information</li> <li>• use measuring equipment as required</li> <li>• re-assemble an engineering mechanism</li> <li>• clean and store equipment as instructed.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• This unit must be assessed in a learning institution.</li> <li>• Assessment must cover the successful disassembly and re-assembly of an engineering mechanism.</li> <li>• The skills covered by this unit would usually be demonstrated by an individual working alone under direct supervision.</li> <li>• The assessment environment should not disadvantage the candidate.</li> <li>• This unit may be assessed in conjunction with any other units addressing the safety, quality, communication, hand tools, machine operation, recording and reporting associated with working</li> </ul>



	on engineering mechanisms.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> <li>• Assessment should be in conjunction with assessment of the project unit and other units integrated into the project.</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Mechanism</b>	<p>A mechanism is any piece of equipment, plant or machinery made up of a number of engineering components. The mechanism should be of a size that can be safely handled by the students and may include but are not limited to:</p> <ul style="list-style-type: none"> <li>• small compressors</li> <li>• small two and four stroke engines</li> <li>• industrial gear boxes</li> <li>• mechanical winches</li> </ul>
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<b>Measuring equipment</b>	Measuring equipment may include but is not limited to: <ul style="list-style-type: none"><li>• micrometers</li><li>• vernier scaled measuring devices</li><li>• rules</li><li>• calipers</li><li>• gauges</li></ul>

## Unit Sector(s)

Competency field

Unit sector

## Custom Content Section

Not applicable.

## MSAENV272B Participate in environmentally sustainable work practices

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This competency covers the outcomes required to effectively measure current resource use and carry out improvements including those reducing negative environmental impacts of work practices.</p> <p>This unit is based on the sustainability guideline standard GCSSUS01A Participate in environmentally sustainable work practices.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency applies to operators/team members who are required to follow procedures so as to work in an environmentally sustainable manner. This ensures regulatory compliance and also aims at minimising environmental risks and maximises the environmental performance of the process and the organisation.</p> <p>It includes:</p> <ul style="list-style-type: none"><li>• Resources used</li><li>• Potential environmental hazards</li><li>• Improving environmental performance (within scope of competency and authority).</li></ul> <p>This competency applies to all sectors of the manufacturing industry and members of its value chain. It may also be applied to all sections of an organisation, including office, warehouse etc. This unit will need to be appropriately contextualised as it is applied across an</p>
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	organisation and across different industry sectors.
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	This unit has <b>no</b> prerequisites	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify current resource use and environmental issues.	1.1. Identify workplace <i>environmental and resource efficiency issues</i> . 1.2. Identify resources used in own work role. 1.3. <i>Measure</i> and record current usage of resources using <i>appropriate techniques</i> .

ELEMENT	PERFORMANCE CRITERIA
	1.4. Identify and report workplace environmental hazards to appropriate personnel.
2. Comply with environmental regulations.	2.1. Follow <i>procedures</i> to ensure <i>compliance</i> . 2.2. Report environmental <b>incidents</b> to appropriate personnel.
3. Seek opportunities to improve environmental practices and resource efficiency.	3.1. Follow <i>enterprise plans</i> to improve environmental practices and resource efficiency. 3.2. Make <i>suggestions</i> for improvements to workplace practices in own work area.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include the ability to:

- report as required by procedures
- follow procedures and instructions and respond to change
- ask questions and seek clarifications relating to work requirements

Reading and writing is required in order to interpret required procedures and complete required workplace forms/reports.

Numeracy is required to interpret numeric workplace information, readings and measurements, handle data as required and complete numeric components of workplace forms/reports.

#### Required knowledge

Competency includes sufficient knowledge to:

- have a basic understanding of sustainability
- know the environmental hazards/risks, resource use and inefficiencies associated with own workplace (at an appropriate level)
- know the relevant environmental and resource efficiency systems and procedures for own work area
- know the impact of laws and regulations to a level relevant to the work context

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competence in this unit must be able to provide evidence of the ability to follow workplace procedures according to instructions given and to participate in the improvement of environmental and resource efficient work practices at own level of responsibility. Evidence must be strictly relevant to the particular workplace role.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify and measure resources used in their job
- identify situations likely to lead to an environmental incident
- follow procedures related to environmental performance.

Consistent performance should be demonstrated. For example, look to see that:

- work is routinely to procedures
- the minimum of resources is used consistent with the job requirements, good practice and the procedures.

#### Context of and specific resources for assessment

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Depending on the selected methods of assessment access may be required to:

- workplace procedures and plans
- documentation in relation to production, waste, overheads, hazard control/management
- reports from supervisors/managers
- case study/scenarios

#### Method of assessment

A holistic approach should be taken to the assessment.

Competence in this unit may be assessed:

- by demonstration in the workplace

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• using targeted questioning for appropriate portions</li> <li>• by use of a suitable simulation and/or a range of case studies/scenarios</li> <li>• by a combination of these techniques.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment.</p>
<b>Guidance information for assessment</b>	Assessors need to be aware of any cultural issues that may affect responses to questions. Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Procedures</b>	All operations are performed in accordance with procedures including all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.
<b>Environmental and resource efficiency issues</b>	<p>Environmental and resource efficiency issues include minimisation of environmental risks and maximisation of opportunities to improve business environmental performance and to promote more efficient production and consumption of natural resources, for example by:</p> <ul style="list-style-type: none"> <li>• minimisation of waste, through implementation of the waste management hierarchy</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• efficient and effective use of energy and other resources</li> <li>• seeking alternative sources of energy</li> <li>• efficient use of materials and appropriate disposal of waste</li> <li>• use of controls to minimise the risk of environmental damage from hazardous substances</li> <li>• efficient water use</li> <li>• reducing emissions</li> <li>• life cycle analysis applied to issues such as energy supply, materials, transport, production</li> </ul>
<b>Measure</b>	<p>Measure should be interpreted in a manner consistent with the scope of the job and may include things like:</p> <ul style="list-style-type: none"> <li>• counting the number of items entering/leaving a work area</li> <li>• reading indicators in the work area</li> <li>• obtaining relevant information from support personnel</li> <li>• other simple means</li> </ul>
<b>Appropriate techniques</b>	<p>Appropriate techniques include:</p> <ul style="list-style-type: none"> <li>• material fed to/consumed by plant/equipment</li> <li>• plant meters and gauges</li> <li>• job cards including kanbans</li> <li>• examination of invoices from suppliers</li> <li>• measurements made under different conditions</li> <li>• examination of relevant information and data.</li> </ul>
<b>Compliance</b>	<p>Compliance includes meeting relevant federal, state and local government laws, by-laws, regulations and mandated codes of practice. It also includes any codes and standards that the enterprise applies voluntarily.</p>
<b>Incidents</b>	<p>Incidents include:</p> <ul style="list-style-type: none"> <li>• breaches or potential breaches of regulations</li> <li>• occurrences outside of standard procedure which may lead to lower environmental performance.</li> </ul>
<b>Enterprise plans</b>	<p>Enterprise plans include:</p>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• documented policies and procedures</li> <li>• work plans to minimise waste, increase efficiency of water/energy use, minimise environmental hazards</li> </ul>
<b>Suggestions</b>	<p>Suggestions include ideas that help to:</p> <ul style="list-style-type: none"> <li>• prevent and minimise environmental risks and maximise opportunities</li> <li>• reduce emissions of greenhouse gases</li> <li>• reduce use of non-renewable resources</li> <li>• improve energy efficiency</li> <li>• increase use of renewable, recyclable, reusable and recoverable resources</li> <li>• reduce waste</li> <li>• increasing the reusability/recyclability of wastes/products</li> <li>• reduce water usage and/or water wastage.</li> </ul>

## Unit Sector(s)

<b>Unit sector</b>	
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## Competency field

<b>Competency field</b>	Competitive manufacturing tools
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## Co-requisite units

<b>Co-requisite units</b>	



## MSAENV472B Implement and monitor environmentally sustainable work practices

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This competency covers the outcomes required to effectively analyse the workplace in relation to environmentally sustainable work practices and to implement improvements and monitor their effectiveness.</p> <p>This unit is based on the sustainability guideline standard GCSSUS02A Implement and monitor environmentally sustainable work practices.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency applies to those who have responsibility for a specific area of work or who lead a work group or team. It addresses the knowledge, processes and techniques necessary to implement and monitor environmentally sustainable work practices, including the development of processes and tools.</p> <p>It includes:</p> <ul style="list-style-type: none"><li>• Identifying areas for improvement</li><li>• Developing plans to make improvements</li><li>• Implementing and monitoring improvements in environmental performance.</li></ul> <p>This competency applies to all sectors of the manufacturing industry and members of its value chain. It may also be applied to all sections of an organisation, including office, warehouse etc. This unit will need to be appropriately contextualised as it is applied across an organisation and across different industry sectors.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	This unit has <b>no</b> prerequisites	

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Investigate current practices in relation to resource usage.	1.1 Identify environmental regulations applying to the enterprise. 1.2 Assess procedures for assessing <b><i>compliance</i></b> with environmental regulations. 1.3 Collect information on environmental and resource efficiency systems and procedures, and provide to the work group where appropriate. 1.4 Measure and record current resource usage by members of the work group.

ELEMENT	PERFORMANCE CRITERIA
	1.5 Analyse and record current purchasing strategies. 1.6 Analyse current work processes to access information and data and assist in identifying areas for improvement.
2. Set targets for improvements.	2.1 Seek input from stakeholders, key personnel and specialists. 2.2 Access external sources of information and data as required. 2.3 Evaluate alternative solutions to workplace environmental issues. 2.4 Set efficiency targets.
3. Implement performance improvement strategies.	3.1 Source <i>techniques/tools</i> to assist in achieving targets. 3.2 Apply continuous improvement strategies to own work area of responsibility and communicate ideas and possible solutions to the work group and management. 3.3 Integrate environmental and resource efficiency improvement plans for own work group with other operational activities and implement them. 3.4 Seek suggestions and ideas about environmental and resource efficiency management from stakeholders and act upon them where appropriate. 3.5 Implement costing strategies to fully value environmental assets.
4. Monitor performance.	4.1 Document outcomes and communicate reports on targets to key personnel and stakeholders. 4.2 Evaluate strategies. 4.3 Set new targets and investigate and apply new tools and strategies. 4.4 Promote successful strategies and reward participants where possible.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

**REQUIRED SKILLS AND KNOWLEDGE**

- using relevant environmental and resource efficiency systems, tools and procedures
- applying quality assurance systems relevant to own work area
- applying relevant supply chain procedures
- measurement and calculation techniques
- communication/consultation skills to ensure information is supplied to the work group

Reading and writing is required to comprehend documentation and interpret environmental and energy efficiency requirements and to document and maintain records

Numeracy is required to interpret numeric workplace information, readings and measurements, handle data as required and complete numeric components of workplace forms/reports.

**Required knowledge**

Required knowledge includes:

- how to access and use relevant environmental and resource efficiency systems, tools and procedures
- understanding of best practice approaches relevant to own area of responsibility
- strategies to maximise opportunities and minimise impacts relevant to own work area
- relevant environmental and resource efficiency issues specific to industry practices
- methods for measuring and calculating resource usage

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

A person who demonstrates competence in this unit must be able to provide evidence of the ability to implement and monitor integrated environmental and resource efficiency management policies and procedures within an organisation.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• monitor and investigate current resource usage</li> <li>• develop plans to improve sustainability</li> <li>• implement environmental improvements.</li> </ul> <p>Consistent performance should be demonstrated. For example, look to see that:</p> <ul style="list-style-type: none"> <li>• environmental performance is routinely monitored and investigated</li> <li>• areas for improvements are followed through and the implemented changes are in turn monitored and investigated.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This section should be read in conjunction with the range of variables for this unit of competency. Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.</p> <p>Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation.</p> <p>A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment. Competence in this unit may be assessed:</p> <ul style="list-style-type: none"> <li>• by demonstration in the workplace</li> <li>• using targeted questioning for appropriate portions</li> <li>• through use of specific project(s)</li> <li>• by use of a suitable simulation and/or a range of case studies/scenarios</li> <li>• by a combination of these techniques.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or</p>

<b>EVIDENCE GUIDE</b>	
	similar assessment.
<b>Guidance information for assessment</b>	<p>Assessors need to be aware of any cultural issues that may affect responses to questions.</p> <p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Procedures</b>	<p>All operations are performed in accordance with procedures.</p> <p>Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.</p> <p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.</p>
<b>Environmental and resource efficiency issues</b>	<p>Environmental and resource efficiency issues include:</p> <ul style="list-style-type: none"> <li>• addressing environmental and resource sustainability initiatives such as Environmental Management Systems, action plans, surveys and audits</li> <li>• reference to standards, guidelines and approaches such as: <ul style="list-style-type: none"> <li>• ISO 14001 Environmental Management Systems</li> <li>• Life Cycle Analyses</li> </ul> </li> </ul>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Cradle to cradle</li> <li>• Global Reporting Initiative</li> <li>• Ecological footprinting</li> <li>• Triple Bottom Line reporting</li> <li>• Product Stewardship</li> <li>• determining enterprise's most appropriate waste treatment including waste to landfill, recycling, re-use and wastewater treatment</li> <li>• applying the waste management hierarchy in the workplace</li> <li>• initiating and/or maintaining appropriate enterprise procedures for operational energy consumption, including stationary energy and non stationary (transport)</li> <li>• efficient use of water</li> <li>• minimising greenhouse gas emissions</li> <li>• use of controls to minimise the risk of environmental damage from hazardous substances</li> </ul>
<b>Measure</b>	<p>Measuring techniques include:</p> <ul style="list-style-type: none"> <li>• material fed to/consumed by plant/equipment</li> <li>• plant meters and gauges</li> <li>• job cards including kanbans</li> <li>• examination of invoices from suppliers</li> <li>• measurements made under different conditions</li> <li>• examination of relevant information and data</li> <li>• others as appropriate to the specific industry contexts.</li> </ul>
<b>Techniques and tools</b>	<p>Techniques and tools may includeÂ :</p> <ul style="list-style-type: none"> <li>• visual workplace concepts</li> <li>• measurement, display and/or recording devices</li> <li>• changed work practices/procedures</li> <li>• competence development and awareness training</li> <li>• process and equipment items</li> </ul>
<b>Compliance</b>	<p>Compliance includes meeting relevant federal, state and local government laws, by-laws, regulations and codes of practice.</p>
<b>Incidents</b>	<p>Incidents include:</p>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• breaches or potential breaches of regulations</li> <li>• occurrences outside of standard procedure which may lead to lower environmental performance</li> </ul>
<b>Purchasing strategies</b>	<p>Purchasing strategies include:</p> <ul style="list-style-type: none"> <li>• influencing suppliers to take up environmental sustainability</li> <li>• selecting materials/components with a lower environmental profile.</li> </ul>
<b>Stakeholders, key personnel and specialists</b>	<p>Stakeholders, key personnel and specialists include individuals and groups both inside and outside the organisation that have some direct interest in the enterprise's conduct, actions, products and services, including:</p> <ul style="list-style-type: none"> <li>• employees at all levels of the organisation</li> <li>• customers</li> <li>• suppliers</li> <li>• other organisations</li> <li>• key personnel within the organisation, and specialists outside it who may have particular technical expertise</li> </ul>
<b>Suggestions</b>	<p>Suggestions includes ideas that help to:</p> <ul style="list-style-type: none"> <li>• prevent and minimise environmental risks and maximise opportunities</li> <li>• reduce emissions of greenhouse gases</li> <li>• reduce use of non-renewable resources</li> <li>• make more efficient use of energy, water and other resources</li> <li>• maximise opportunities to re use and recycle materials</li> <li>• identify strategies to offset or mitigate environmental impacts. e.g. purchasing of carbon credits</li> <li>• express purchasing power through the selection of suppliers with improved environmental performance. e.g. purchasing renewable energy and materials with lower embedded carbon</li> <li>• eliminate the use of hazardous and toxic materials increasing the reusability/recyclability of wastes/products.</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	
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**Competency field**

<b>Competency field</b>	Competitive manufacturing tools
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**Co-requisite units**

<b>Co-requisite units</b>		

## MSAENV672B Develop workplace policy and procedures for environmental sustainability

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	<p>This competency covers the outcomes required to develop and implement a workplace sustainability policy, including the modification of the policy to suit changed circumstances.</p> <p>This unit is based on the sustainability guideline standard GCSSUS03A Develop workplace policy and procedures for sustainability.</p>
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### Application of the Unit

<b>Application of the unit</b>	<p>This competency applies to team leaders/supervisors/managers who are required to develop approaches to environmental sustainability within workplaces, including the development and implementation of policy.</p> <p>It includes:</p> <ul style="list-style-type: none"><li>• Communicating with relevant stakeholders</li><li>• Developing and monitoring sustainability policies</li><li>• Reviewing and improving sustainability policies.</li></ul> <p>This competency applies to all sectors of the manufacturing industry. It may also be applied to all sections of an organisation, including office, warehouse etc.</p> <p>This unit will need to be appropriately contextualised as it is applied across an organisation and across different industry sectors.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Prerequisite units	This unit has <b>no</b> prerequisites	

## Employability Skills Information

Employability skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Develop workplace sustainability policy.	1.1 Define <i>scope of sustainability policy</i> . 1.2 Identify and consult <i>stakeholders</i> as a key component of the policy development process. 1.3 Review environmental sustainability <i>strategies</i> relevant to all stages of work covered by the policy 1.4 Make recommendations for policy options based on likely effectiveness, timeframes and cost. 1.5 Develop policy is that reflects the organisation's commitment to sustainability as an integral part of the

ELEMENT	PERFORMANCE CRITERIA
	business planning and as a business opportunity. 1.6 Agree upon appropriate methods of implementation.
2. Communicate the policy.	2.1 Promote the policy, including its expected outcome to key stakeholders. 2.2 Inform those involved in implementing the policy as to outcomes expected, activities to be undertaken and responsibilities assigned.
3. Implement the policy.	3.1 Develop and communicate procedures to help implement the policy. 3.2 Implement <i>strategies</i> for continuous improvement in resource efficiency. 3.3 Establish record systems for tracking continuous improvements in sustainability approaches and assign responsibilities.
4. Review policy implementation	4.1 Record outcomes and provide feedback to key personnel and stakeholders. 4.2 Investigate success or otherwise of policy. 4.3 Monitor records to identify trends that may require remedial action, and use to promote continuous improvement of performance. 4.4 Modify policy and or <i>procedures</i> as required to ensure improvements are made.

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- developing and implementing systems and procedures to aid in the achievement of sustainability in the workplace
- applying quality assurance systems relevant to own enterprise
- accessing and applying other relevant enterprise policies, procedures and protocols
- relevant industry competency
- interpreting business/strategic plans

This unit requires the ability to:

## REQUIRED SKILLS AND KNOWLEDGE

- read and evaluate complex and formal documents such as policy and legislation
- research, analyse and present information
- prepare written reports requiring precision of expression and language and structures suited to the intended audience
- adjust communication to suit different audiences
- deal with different points of view and dissenting stakeholders.

### Required knowledge

Required knowledge includes:

- understanding of relevant policy development and implementation processes and practices
- understanding of the principles, practices and available tools and techniques of sustainability management relevant to the particular industry context
- best practice approaches relevant to own work area
- equal employment opportunity, equity and diversity principles and occupational health and safety implications of policy/s being developed

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

A person who demonstrates competence in this unit must be able to provide evidence of the ability to develop and implement integrated sustainability policies and procedures within an enterprise. The review of the policy after implementation will also need to be evidenced.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- develop relevant policy and procedures that comply with the regulatory requirements and business plans
- develop a workable implementation strategy
- include measurable criteria for reviewing improvement.

Consistent performance should be demonstrated. For

<b>EVIDENCE GUIDE</b>	
	<p>example, look to see that:</p> <ul style="list-style-type: none"> <li>• policy implementation is reviewed</li> <li>• policy is developed to become part of the routine practices of the organisation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This section should be read in conjunction with the range of variables for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation.</p> <p>A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<p>Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.</p> <p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed:</p> <ul style="list-style-type: none"> <li>• by demonstration in the workplace</li> <li>• using targeted questioning for appropriate portions</li> <li>• through use of specific project(s)</li> <li>• by use of a suitable simulation and/or a range of case studies/scenarios</li> <li>• by a combination of these techniques.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment.</p>
<b>Guidance information for assessment</b>	<p>Assessors need to be aware of any cultural issues that may affect responses to questions.</p> <p>Assessment processes and techniques must be culturally</p>



## EVIDENCE GUIDE

	appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.
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## Range Statement

### RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

#### Procedures

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

#### Scope of sustainability policy

Scope of sustainability policy include:

- The area/s of environmental sustainability to be targeted and whether social and economic sustainability will be incorporated
- The parts of the enterprise to which it is to apply, including whether it is for the whole enterprise, one site, one work area or combinations of these
- An investigation of the particular business and market context of the industry/ enterprise
- Addressing sustainability initiatives through reference to standards, guidelines and approaches such as:
  - ISO 14001 Environmental Management Systems
  - Life Cycle Analyses

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• Cradle to grave/cradle to cradle</li> <li>• Global Reporting Initiative</li> <li>• Ecological Footprint Assessment</li> <li>• Triple Bottom Line reporting</li> <li>• Product Stewardship.</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders include individuals and groups both inside and outside the organisation that have some direct interest in the enterprise's conduct, actions, products and services, including:</p> <ul style="list-style-type: none"> <li>• employees at all levels of the organisation</li> <li>• customers</li> <li>• suppliers</li> <li>• regulators</li> <li>• other organisations.</li> </ul>
<b>Strategies</b>	<p>Implementation strategies include:</p> <ul style="list-style-type: none"> <li>• awareness raising among stakeholders</li> <li>• training of staff in principles and techniques of sustainability</li> <li>• promotional activities.</li> </ul> <p>Continuous improvement strategies include ongoing measuring, improving and monitoring such as:</p> <ul style="list-style-type: none"> <li>• Plan, do, check, act cycles</li> <li>• Kaizen (continuous improvement)</li> <li>• Kaizen blitz (breakthrough improvement event)</li> <li>• Six sigma approaches</li> </ul> <p>Environmental sustainability strategies include:</p> <ul style="list-style-type: none"> <li>• reducing toxic material and hazardous chemical use</li> <li>• minimising resource use through changes in processes, facility design and management</li> <li>• supply chain and life cycle management approaches</li> <li>• sourcing renewable energy and low carbon footprint materials</li> <li>• reducing, re-using, recycling and waste</li> </ul>

## RANGE STATEMENT

	reduction <ul style="list-style-type: none"> <li>• product and process improvements</li> <li>• carbon offsets</li> <li>• reducing greenhouse gas and other emissions</li> </ul>
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## Unit Sector(s)

Unit sector	
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## Competency field

Competency field	Competitive manufacturing tools
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## Co-requisite units

Co-requisite units		

# MSAPCI101A Adapt to work in industry

## Modification History

Not applicable.

## Unit Descriptor

### Unit Descriptor

This unit covers the fundamental knowledge and skills needed when taking up employment within the manufacturing industry. It includes the application of industry and workplace guidelines and procedures in a day to day work context as well as appropriate work behaviour.

The elements of this unit should always be assessed in conjunction with other units that form part of a specified job function.

Training and assessment against this competency unit must incorporate all relevant legislative and regulatory requirements.

## Application of the Unit

### Application of the Unit

The unit has applications in qualifications for all occupations in the manufacturing industry and it should be regarded as an integrating unit. When delivered/assessed as part of a qualification, the unit will be customised to ensure its relevance to the real or simulated work activities and related workplaces.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

**Employability Skills** This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

### ELEMENT

### PERFORMANCE CRITERIA

#### 1 Manage one's own learning

- 1.1 One's personal goals or vision are considered and articulated
- 1.2 Opportunities for learning new ideas and techniques in relation to personal goals are identified
- 1.3 Personal learning needs and **skill gaps** are recognised
- 1.4 Opportunities for **skills development activities** are identified in liaison with relevant personnel
- 1.5 A range of **learning tools and practices** are accessed and applied to the job
- 1.6 Advantage is taken of **on-the-job** and **off-the-job learning opportunities**

#### 2 Adapt to and demonstrate appropriate work practice

- 2.1 Work requirements are identified and interpreted with advice from appropriate persons
- 2.2 **Appropriate dress and behaviour** are observed in the workplace
- 2.3 Work and personal priorities are identified and a balance is achieved
- 2.4 **Time management strategies** are applied to work

ELEMENT	PERFORMANCE CRITERIA
	duties
	2.5 Interactions with others is tailored to take into account different backgrounds, cultures and languages
3 Work within organisational requirements	3.1 <b>Organisational requirements</b> and key activities of the workplace are identified
	3.2 Relevant <b>workplace policies and guidelines</b> are identified and applied to work undertaken
	3.3 <b>The range of organisational values and cultural norms</b> are interpreted
	3.4 Any uncertainties are discussed with key personnel and clarified
4 Identify the sectors of the industry	4.1 The <b>main sectors</b> of the manufacturing industry, their key activities and the way in which they inter-relate are identified
	4.2 The <b>roles and responsibilities</b> of the manufacturing industry are clarified
	4.3 <b>Key industry representatives</b> and their roles are identified
	4.4 <b>Current issues or events</b> impacting on the industry are identified
5 Identify industry sector products and services	5.1 The <b>products</b> provided by the industry sector are identified
	5.2 The <b>services</b> provided by the industry sector are identified
	5.3 Appropriate <b>standards of service</b> across the industry sector are identified
	5.4 <b>Quality standards</b> for products and services as identified by the industry are clarified

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This describes the essential skills and knowledge required for this unit.

## **REQUIRED SKILLS AND KNOWLEDGE**

### **REQUIRED KNOWLEDGE**

Knowledge and understanding are essential to apply this competency standard in the industry and workplace. The requirements for this competency standard are a knowledge and basic understanding of:

- current events, activities, products and services of the manufacturing industry
- workplace policies, procedures and guidelines
- time management strategies and appropriate workplace etiquette
- workplace equipment, tools and other technologies used in the manufacturing industry and where and how to obtain information and instructions on their safe use and basic care and servicing
- sources of information on the industry sector and skills development activities

### **REQUIRED SKILLS**

To achieve the performance criteria, some complementary skills are required. These are the ability to:

- following directions
- literacy skills in regard to written and verbal communication in the workplace
- basic interpersonal and communication skills (including listening and questioning, receiving feedback)(
- workplace technology skills where appropriate or required
- following relevant OHS and environmental protection procedures and responsibilities
- time management strategies (
- adapt and modify activities depending on differing workplace contexts and environment
- apply relevant industrial or other legislative requirements
- recognise and adapt appropriately to cultural differences in the workplace, including modes of behaviour and interactions among staff and others
- recognise limitations, ask for help and seek clarification or information about work requirements and procedures

## **Evidence Guide**

### **EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with

## EVIDENCE GUIDE

the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

- Assessment must confirm appropriate knowledge and skills to:
- identify and interpret information on sectors in the manufacturing industries
- identify and interpret information on the range of products and services produced by manufacturing industries
- complete work tasks in accordance with workplace requirements, standards and applicable regulations
- adapt to and apply workplace procedures and practice
- identify and take advantage of learning opportunities in the workplace
- Performance is demonstrated consistently over a period of time and in a suitable range of contexts
- Consistently applies required knowledge and skills when adapting to workplace requirements:
- Consistently shows evidence of application of relevant workplace procedures, policies, instructions and regulations, including:
  - relevant regulatory requirements
  - workplace procedures, policies and standards
  - relevant manufacturer's guidelines relating to the operation and use of equipment
- Action is taken promptly to report and/or rectify any workplace problems in accordance with workplace procedures
- Recognises and adapts appropriately to cultural differences in the workplace, including modes of behaviour and interactions among staff and others
- Work is completed systematically with required attention to detail without damage to goods, equipment or personnel

### **Context of assessment**

- Assessment of this unit must be carried out or managed by a registered training organisation:
- assessment of knowledge must be conducted



## EVIDENCE GUIDE

	<p>through appropriate written/oral examinations and questions</p> <ul style="list-style-type: none"> <li>• practical assessment must occur:</li> <li>• in suitable simulations of a work environment organised by the registered training organisation, and/or</li> <li>• in an appropriate workplace</li> </ul>
<b>Specific resources required for assessment</b>	<p>Access is required to opportunities and appropriate resources to either:</p> <ul style="list-style-type: none"> <li>• carry out a range of suitably simulated practical and knowledge assessments that demonstrate the skills and knowledge to adapt to workplace requirements(usually as part of a holistic assessment involving other competency units)</li> <li>• participate in actual workplace activities that demonstrate the skills and knowledge to adapt to workplace requirements</li> </ul>

## Range Statement

### RANGE STATEMENT

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance.

#### 1. What are **skill gaps**?

**Skill gaps** include a range of skills needed for the workplace or for a particular job which are currently not developed within an individual. They are different from an individual's 'personal learning needs' as they are skills specifically relevant and required for a particular job. They may include:

- physical capacity skills
- workplace technology skills such as business equipment, computer technology, machinery, hand tools, bags, security systems
- numeracy and literacy skills
- customer service skills
- communication skills such as listening and understanding, speaking clearly/directly, reading, writing

## RANGE STATEMENT

2. What are **skill development activities**?

- technical skills

**Skill development activities** may include:

- training courses
- IT courses
- human resources programs
- coaching and mentoring programs
- having access to a mentor for questions and advice
- having the chance to learn a new task or to operate a new piece of equipment or workplace technology
- participating in an external or internal training program
- guided workplace experience

3. What are **learning tools and practices**?

**Learning tools and practices** may include:

- learning through note taking
- reviewing manuals and training guides
- discussion
- practice
- observation
- trial and error
- or a combination of any of these

4. What **on-the-job opportunities** might be accessed and used?

**On-the-job opportunities** may include:

- filling in for a co-worker in a new area
- attending talks or seminars arranged by the workplace
- shadowing another co-worker in a different area
- receiving on the job training and supervised practice

5. What **off-the-job opportunities** might be accessed and used?

**Off-the-job opportunities** may include:

- taking a course with a training provider
- attending conferences or seminars
- attending site visits with supervisor
- participating in workplace social events
- participating in community events

6. What is appropriate **dress and behaviour**?

**Appropriate dress and behaviour** may include:

- personal dress, safety equipment and dress, presentation

## RANGE STATEMENT

- demeanour and attitude displayed to customers and fellow employees
7. What are **time management strategies**?
- Time management strategies** may include:
- being punctual
  - goal setting
  - balancing work and personal priorities or agendas
  - prioritisation of required tasks or activities
  - planning daily or weekly work
  - overcoming procrastination
  - dealing with interruptions (contingency planning)
  - organising your work environment
8. What are **organisational requirements**?
- Organisational requirements** may include:
- organisational policies and guidelines
  - common organisational practice
  - performance plans
  - OHS policies, procedures and programs
9. What are **workplace policies and guidelines**?
- Workplace policies and guidelines** may include but are not limited to:
- attendance
  - punctuality
  - standards for health and fitness
  - obeying orders
  - confidentiality
  - dress codes
  - alcohol and drug restrictions
  - personal safety and duty of care related to OHS
  - terms and conditions of employment
10. What are **organisational values**?
- Organisational values** generally refers to those mentioned in a mission or vision statement of a company and may include:
- innovation
  - community responsibility
  - environment responsibility
11. What are **cultural norms**?
- Cultural norms** may include:

## RANGE STATEMENT

- manners
- meanings specific to the language of the workplace
- history
- workplace etiquette

12. What are the **main sectors** of the industry?

**Main sectors** of industry may include:

- textiles, clothing & footwear
- furniture
- chemical manufacturing
- plastics and rubber products manufacturing
- maintenance and engineering
- manufacture of glass or concrete products

13. What are the **roles and responsibilities** of the industry?

The **roles and responsibilities of the industry** may include:

- providing quality products and services
- providing quality customer service
- providing proper training to those in the industry

14. Who are **key industry representatives**?

**Key industry representatives** may include:

- industry associations
- enterprises
- unions
- legislative bodies

15. What might **current issues or events** include?

**Current issues or events** may include:

- economic
- environmental
- political
- technological
- supply and demand

16. What are **industry products**?

**Industry products** are the outcomes of manufacturing processes and may include:

- clothing and footwear
- concrete and glass products
- tyres and plastic car components
- electronic components
- metal products

17. What are **industry services**?

**Industry services** may include:

- customer support

## RANGE STATEMENT

- product advice
- health, diet advice
- delivery services
- consulting services
- warranties and/or guarantees

18. What are **service standards**?

**Service standards** will vary from industry to industry and even from workplace to workplace depending on the job role and context. It may include:

- developing and maintaining product and service knowledge
- identifying customer needs and expectations correctly
- meeting reasonable needs and request of customers within acceptable time frames
- taking opportunities to enhance the quality of products and services
- dealing with conflict situations
- responding to customer complaints
- maintaining a positive and cooperative manner
- establishing relationships with customers
- following appropriate hygiene and safety procedures
- referring difficult complaints to appropriate persons

19. What are **quality standards**?

**Quality standards** may include:

- consistency standards
- quality specifications
- time requirements
- meeting customer requirements

## Unit Sector(s)

Unit sector

Manufacturing Pathways

## MSAPMSUP106A Work in a team

### Modification History

Not applicable.

### Unit Descriptor

#### Unit descriptor

This competency covers the organisation of team activities to fit in with the scheduling of work to meet operational guidelines.

### Application of the Unit

#### Application of this unit

This competency is typically performed by people who work within a team structure with limited discretionary powers

The worker will:

- plan and organise activities in accordance with instructions
- use appropriate interpersonal skills to contribute to effective teamwork
- seek assistance from other team members where appropriate
- complete logs and reports.
- 

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

#### Prerequisites

This unit has **no** prerequisites.

Individual organisations may choose to add prerequisites and corequisites relevant to their processes.

## Employability Skills Information

### Employability Skills

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
Elements describe the essential outcomes of a unit of competency	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.

## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.
1. Identify work activities.	1.1 Identify task requirements of the team. 1.2 Identify individual tasks that are part of the team requirement. 1.3 Prioritise team and individual activities as directed.
2. Organise daily work plan.	2.1 Break work activities down into small achievable components. 2.2 Record activities as required by procedures/work instructions. 2.3 Seek assistance from other team members when difficulties in achieving allocated tasks arise.
3. Participate in a team.	3.1 Use interpersonal skills appropriate to the effective teamwork of the shift/crew/section within the workplace. 3.2 Acknowledge information and feedback provided by other team members in work group. 3.3 Acknowledge team roles and support team members in achieving their role. 3.4 Practise teamwork within and between groups to contribute to the achievement of company work

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.
	standards.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Knowledge and understanding of organisation information systems, procedures and equipment sufficient to plan daily work activities in order to meet timelines.

Knowledge of organisation standard procedures and work instructions and relevant regulatory requirements, along with the ability to implement them within appropriate time constraints and in a manner relevant to the operation of the system.

Competence also includes the ability to:

- use effective communication techniques
- identify where teams fit into the organisational structure
- apply organisation quality and safety procedures
- complete required workplace documentation
- distinguish between urgent and non-urgent tasks.

### Language, literacy and numeracy requirements

This unit requires the ability to read and understand typical product specifications, job sheets, procedures and work instructions, material labels and safety information as provided.

Writing is required to the level of completing workplace forms.

Basic numeracy is required to the extent required by work instructions and procedures.

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, required skills and knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

### Overview of assessment

A holistic approach should be taken to the assessment.



Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to identify work activities and prioritise work in order to meet timelines, whilst interacting as a member of a group.

Consistent performance should be demonstrated. For example, look to see that:

- activities are planned in accordance with instructions
- willingness to participate as part of a team is demonstrated
- relevant procedures are accessed and utilised in completing activities
- timelines are adhered to
- assistance is sought from relevant personnel when difficulties arise.

### **Assessment method and context**

Assessment will occur on-the-job or in a simulated workplace.

Competence in this unit may be assessed:

- by observation over time on a processing plant or in a manufacturing environment
- in a situation allowing the generation of evidence of the ability to respond to problems
- by using a suitable simulation and/or a range of case studies/scenarios
- through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to all work environments and sectors in the manufacturing industries.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as PPE.

### **Hazards**

Typical workplace hazards include:

- chemicals and hazardous materials
- gases and liquids under pressure
- moving machinery
- materials handling
- working at heights, in confined spaces, or in environments subjected to heat, noise, dust or vapours.

### **Problems**

Respond to routine problems means 'apply known solutions to a limited range of predictable problems'. Typical problems include:

- required information/materials not available
- required tool/equipment not available
- conflict of work priorities
- interpersonal conflict within the team.

Appropriate action for non-routine problems may be reported to designated person or other action specified in the procedures.

## **Unit Sector(s)**

Not applicable.

## MSATCM304A Interpret basic binary phase diagrams

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit Descriptor</b>	This unit covers the knowledge and skills needed to interpret phase diagrams and so predict the microstructures of binary alloys.
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### Application of the Unit

<b>Application of the unit</b>	This unit applies to the interpretation of cooling phase diagrams as used in metallurgy. The application will primarily be to phase diagrams of metals and alloys showing temperature and composition variables. In a typical scenario, a metallurgical technician will be required to recommend a phase transition process in order to obtain a required microstructure, or to predict a microstructure from a known phase transition process.
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### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

<b>Pre-requisite Units</b>	

## Employability Skills Information

<b>Employability Skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Identify the microstructures from an equilibrium cooling phase diagram	1.1. Phase diagram for metal or alloy is obtained from internal or external sources 1.2. Identify number, composition, proportion and structural arrangement of phases in binary alloys. 1.3. Describe structural changes due to varying proportion of alloying elements and temperature. 1.4. Describe the phase changes and final microstructures of binary alloys cooled under equilibrium conditions from the melt or during heat treatment operations.
2. Identify the microstructures from a non equilibrium cooling phase diagram	2.1. Identify number, composition, proportion and structural arrangement of phases in binary alloys. 2.2. Describe structural changes due to varying proportion of alloying elements and temperature. 2.3. Describe the phase changes and final microstructures of binary alloys cooled under equilibrium conditions from the melt or during heat treatment operations.
3. Recognise characteristic microstructures of binary alloys	3.1. Recognise characteristic structures of dendrites (homogeneous and cored) columnar and equiaxed grains. 3.2. Recognise characteristic structures resulting from eutectic, eutectoid and peritectic reactions. 3.3. Recognise characteristic structures resulting from solid state precipitation.

## Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE
This describes the essential skills and knowledge and their level, required for this unit.
<b>Required skills:</b>
<ul style="list-style-type: none"> <li>produce a basic cooling phase diagram from supplied data</li> <li>estimate composition from the structure of a phase diagram</li> <li>predict structure from the composition from a phase diagram</li> </ul>
<b>Required knowledge:</b>
<p>Competency includes sufficient knowledge of:</p> <ul style="list-style-type: none"> <li>methods of construction of phase diagrams for binary alloys.</li> <li>the phase changes that occur in binary alloy systems as recorded by the appropriate phase diagrams.</li> <li>the equilibrium and non equilibrium cooling of binary alloys and the resulting microstructures in cast and heat treated material.</li> </ul>

## Evidence Guide

EVIDENCE GUIDE	
The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	The person will be able to interpret binary phase diagrams. Assessment may be by workplace project, case study or suitable alternative.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>It is essential that competence is demonstrated in the ability to:</p> <ul style="list-style-type: none"><li>• recognise and use correct scientific terminology in regards to phase diagrams</li><li>• source phase diagrams and other reference material from internal or external sources</li><li>• use phase diagrams to interpret intermediate and final phase structures of binary alloys</li></ul>
<b>Relationship to other units</b>	This unit may be assessed concurrently with other relevant units.

**EVIDENCE GUIDE****Assessment method and context**

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the elements, performance criteria, skills and knowledge. A holistic approach should be taken to the assessment.

Assessors should gather sufficient, fair, valid, reliable, authentic and current evidence from a range of sources. Sources of evidence may include direct observation, reports from supervisors, peers and colleagues, project work, samples, organisation records and questioning. Assessment should not require language, literacy or numeracy skills beyond those required for the unit.

The assessee will have access to all techniques, procedures, information, resources and aids which would normally be available in the workplace. The method of assessment should be discussed and agreed with the assessee prior to the commencement of assessment.

**Resource implications**

This section should be read in conjunction with the range of variables for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>RANGE STATEMENT</b>	
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, it is expected the latest version will be used.
<b>Scientific techniques and principles of cooling phase diagrams relate to</b>	<ul style="list-style-type: none"> <li>• Equilibrium phase diagrams</li> <li>• Non-equilibrium phase diagrams</li> <li>• Effect of temperature and alloying elements on structural changes</li> <li>• Structures of homogenous and cored dendrites</li> <li>• Structures of columnar and equiaxed grains</li> <li>• Eutectic, eutectoid and peritectic reactions</li> </ul>

### Unit Sector(s)

<b>Unit Sector</b>	Metallurgy
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### Competency field

<b>Competency Field</b>	
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### Co-requisite units

<b>Co-requisite Units</b>		

## MSATCS301A Interpret architectural and engineering design specifications for structural steel detailing

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to interpret design related information required for the commencement of a structural steel detailing project.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to the initial receiving and checking of design related information by structural steel detailers including obtaining additional information or clarifying information already received. Structural steel detailers must obtain and interpret design related information from architects and consulting engineers in order to carry out structural steel detailing. The unit may apply to structural steel detailing carried out for residential, commercial, industrial or mining fabrication and construction projects.</p> <p>The unit assumes that knowledge of basic technical drawing conventions and procedures such as view, dimensioning, drawing layout, etc. is already held.</p> <p>Work is conducted according to defined procedures.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p> <p>This unit requires the application of skills associated with planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	<i>MEM09002B</i>	<i>Interpret technical drawing</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Obtain and check adequacy of design related information for structural steel detailing purposes	<p>1.1. General arrangement drawings are obtained and interpreted including standard symbols, terms and figures used by designers</p> <p>1.2. Adequacy of arrangement information is checked against detailer and client requirements</p> <p>1.3. Design information is checked for any drawings or descriptions of any members, connections, components or details that lie outside the scope of standard structural practice</p> <p>1.4. Information on suspended floors is obtained and checked</p> <p>1.5. Column base layouts and schedules, if any, are</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>checked</p> <p>1.6.Specifications for grades of steel and bolt grades are obtained and checked</p> <p>1.7.Information on standards and other design related specifications to be shown on detail drawings is checked</p>
2. Obtain additional information where required	<p>2.1.Requests for further information (RFIs) are submitted according to enterprise and project procedures</p> <p>2.2.Adjustments to design information are made based on RFI responses and noted according to standard drawing office procedures</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- assess design information for adequacy of information needed for structural steel detailing
- liaise with architects and engineers
- assess scope of structural steel detailing tasks and priorities
- interpret design drawings, sketches and schedules
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual instructions
- communicate at all levels about technical issues related to patterns and specifications
- reading and numeracy is required to the level of interpreting workplace documents and technical information

#### Required knowledge

- architectural and engineering design drawings including standard symbols, terms, abbreviations and sketches
- structural steel members and connections used in structural steel construction
- the difference between design and detail drawing processes
- drawing office procedures

## REQUIRED SKILLS AND KNOWLEDGE

- fabrication processes and procedures

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Demonstrates skills and knowledge to:

- identify and interpret architect and engineer design specifications for structural steel constructions including constructions with suspended floors
- relate design information to structural steel detailing processes including checking of adequacy of design information for the construction
- establish efficient administrative arrangements for liaison with designers including arrangements for formal requests for further information
- establish drawing and document control procedures

#### Context of and specific resources for assessment

Assessment may occur on the job or in an appropriately simulated environment

Resource implications for this unit include:

- access to real or appropriately simulated detailing of structural steel constructions including provision of suitable design information
- computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment
- access to steel and component manufacturers' catalogues or websites
- access to relevant standards through either hard copy or internet access.

Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.

<b>EVIDENCE GUIDE</b>	
	Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>• Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative/regulatory</b>	All work must comply with relevant Federal and State or Territory legislative or regulatory

<b>RANGE STATEMENT</b>	
<b>requirements</b>	requirements
<b>Drawings</b>	For the purposes of this unit drawings refers to both hard copy and software files including CAD files
<b>Designers</b>	Designers include architects and consulting engineers. The design information may also be provided via drawings produced by design draftspersons
<b>Adequacy</b>	Adequacy means that sufficient design information is provided to enable the structural steel detailer to prepare drawings that will provide all information required for fabrication and erection
<b>Adequacy of arrangement information</b>	<p>Adequacy of arrangement information refers to the information normally provided on arrangement or layout drawings provided by architects and/or consulting engineers. This information includes:</p> <ul style="list-style-type: none"> <li>• building orientation</li> <li>• layout on a site and relationship to any other structures</li> <li>• primary dimensions</li> <li>• floor levels</li> <li>• beam spacing</li> <li>• column centres</li> <li>• sizes for all members, for example, beams, trusses, columns, rafters, purlins, girts, braces, crane beams</li> <li>• dimensions and layout drawing for any special features, for example, stairs, landings, fire escapes, and so on</li> </ul>
<b>Client requirements</b>	<p>Client requirements may include:</p> <ul style="list-style-type: none"> <li>• shop detail drawings, erection diagrams and material schedules and lists</li> <li>• program and format for CAD files and models</li> <li>• downloading by the structural steel detailer of files direct to client computers and CNC machines</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• size and number of hard copy drawings</li> <li>• specification of programs and requirements for word processed documents, spreadsheets, presentations, invoices, and so on</li> </ul>
<b>Suspended floors</b>	Suspended floors may consist of reinforced concrete slab, composite slab, pre-cast planks and topping, steel plate or grating, or other specified material
<b>Work environment</b>	<p>Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.</p> <p>Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper based and electronic instructions.</p>

## Unit Sector(s)

<b>Unit sector</b>	Structural steel detailing
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## Competency field

<b>Competency field</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## MSATCS302A Detail bolts and welds for structural steelwork connections

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to detail bolts and welds for structural steelwork connections consistent with design specifications.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a structural steel detailer who has to detail various types of bolts and welds for structural steelwork connections. The detailing may be done manually or by using CAD and/or proprietary steel detailing software.</p> <p>The unit may apply to structural steel detailing carried out for residential, commercial, industrial or mining fabrication and construction projects.</p> <p>The unit assumes that knowledge of basic technical drawing conventions and procedures such as view, dimensioning, drawing layout, etc. is already held.</p> <p>Work is conducted according to defined procedures.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p> <p>This unit requires the application of skills associated with planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	<i>MEM09002B</i>	<i>Interpret technical drawing</i>
	<i>MEM05051A</i>	<i>Select welding processes</i>
	<i>MSATCS301A</i>	<i>Interpret architectural and engineering design specifications for structural steel detailing</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
1. Determine shop and field connections from design drawings	1.1.Fabrication shop capabilities and preferences are discussed with fabricator 1.2.Connections are allocated as shop or field welded in conjunction with fabricator 1.3.Connections to be field bolted are allocated and extent of shop preparation of connections decided 1.4.Connection fittings are allocated to either columns



ELEMENT	PERFORMANCE CRITERIA
	<p>or beams to suit fabrication efficiency or design requirements</p> <p>1.5.A request for further information (RFI) is made to design engineer where clarification of requirements is needed</p>
2. Detail bolts for connections	<p>2.1.Knowledge of standard bolting category identification system is demonstrated</p> <p>2.2.Bolt types and sizes for each connection are specified using design information and consideration of commercial availability</p> <p>2.3.Bolt and thread lengths are selected according to design specifications, and connection requirements</p> <p>2.4.Bolt and bolt holes are detailed taking into account AS 4100 requirements, tightening and tensioning specifications and clearances</p> <p>2.5.Field bolt list is prepared and checked and sent to fabricator</p>
3. Detail welds for connections	<p>3.1.Knowledge of joint and weld types is demonstrated</p> <p>3.2.Shop and field welds are identified</p> <p>3.3.Standard welding symbols are used</p> <p>3.4.Clearances for welding are applied</p> <p>3.5.Field weld details are placed on erection plans and shop drawings and submitted to design engineer for approval</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- assess design information for adequacy of information needed for structural steel detailing
- liaise with design engineers
- assess scope of structural steel detailing tasks and priorities
- interpret design drawings, sketches and schedules
- determine bolt and thread length taking into account:
  - shank lengths as defined in AS 1111 and AS 1252

**REQUIRED SKILLS AND KNOWLEDGE**

- whether the thread is to be included or excluded in the shear plane
- grip and ply thicknesses
- thread projection as per AS 4100
- nut and washer requirements
- detail welds consistent with design information and AS4100 and AS 1101 Part 3
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual instructions
- communicate at all levels about technical issues related to patterns and specifications
- reading and numeracy is required to the level of interpreting workplace documents and technical information

**Required knowledge**

- architectural and engineering design drawings including standard symbols, terms, abbreviations and sketches
- structural steel members and connections used in structural steelwork
- the difference between design and detail drawing processes
- drawing office procedures
- fabrication processes and procedures
- the Australian steel structures limit state design code's (AS4100) requirements in so far as they impact on steel detailing
- Australian standard bolting category identification system
- bolt and thread length considerations including:
  - shank lengths as defined in AS 1111 and AS 1252
  - inclusion or exclusion of the shear plane in the thread
  - grip and ply thicknesses
  - thread projection requirements as per AS 4100
  - nut and washer requirements
- standard welding symbols as described in AS 1101 Part 3 welding theory and processes

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

<b>EVIDENCE GUIDE</b>	
Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Demonstrates skills and knowledge to:</p> <ul style="list-style-type: none"> <li>• identify and interpret engineering design specifications for structural steel bolted and welded connections</li> <li>• relate design information to structural steel detailing processes</li> <li>• correctly use the Australian standard bolting category identification system</li> <li>• understand and apply the relevant sections of AS 1101 Part 3, AS4100, AS 1111 and AS 1252</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment</p> <p>Resource implications for this unit include:</p> <ul style="list-style-type: none"> <li>• access to real or appropriately simulated detailing of ancillary structural steelwork including provision of suitable design information for bolts and welds</li> <li>• computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment</li> <li>• access to steel and component manufacturers' catalogues or websites</li> <li>• access to relevant standards through either hard copy or internet access.</li> </ul> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of</li> </ul>

<b>EVIDENCE GUIDE</b>	
	<p>tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</p> <ul style="list-style-type: none"> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>• Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative/regulatory requirements</b>	All work must comply with relevant Federal and State or Territory legislative or regulatory requirements
<b>Bolt and thread lengths</b>	Bolt and thread lengths may be specified by the engineer or by the detailer
<b>Standard welding symbols</b>	Standard welding symbols as described in AS 1101 Part 3
<b>Work environment</b>	Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.

**RANGE STATEMENT**

	Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper based and electronic instructions.
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**Unit Sector(s)**

<b>Unit sector</b>	Structural steel detailing
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## MSATCS501A Detail standardised structural connections

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to identify bolted or welded connections for structural steelwork that is consistent with design specifications and to detail these connections in structural steelwork detailed drawings. Both steel to steel and steel to non-steel connections are covered by this unit. Portal frame haunch connections, column base plate and holding down bolt layouts, and steel to non-steel connections are also covered by this unit.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a structural steel detailer who has to detail the various types of standard connections used in structural steelwork. Standard connections are those listed in the latest edition of the Australian Steel Institute's <i>Standardised Structural Connections</i> publication.</p> <p>Connections covered include flexible and rigid connections and purlin cleats.</p> <p>The unit may apply to structural steel detailing carried out for residential, commercial, industrial or mining fabrication and construction projects. The detailing may be done manually or by using CAD and/or proprietary steel detailing software.</p> <p>The unit assumes that knowledge of basic technical drawing conventions and procedures such as view, dimensioning, drawing layout, etc. is already held.</p> <p>Work is conducted according to defined procedures.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p>
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	This unit requires the application of skills associated with planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	<i>MEM09002B</i>	<i>Interpret technical drawing</i>
	<i>MEM05051A</i>	<i>Select welding processes</i>
	<i>MSATCS301A</i>	<i>Interpret architectural and engineering design specifications for structural steel detailing</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine shop and field connections from design drawings	<p>1.1.Fabrication shop capabilities and preferences are discussed with fabricator</p> <p>1.2.Connections are allocated as shop or field welded in conjunction with fabricator</p> <p>1.3.Connections to be field bolted are allocated and extent of shop preparation of connections decided</p> <p>1.4.Connection fittings for structural connections are allocated to either columns or beams to suit fabrication efficiency or design requirements</p>
2. Identify required connections	<p>2.1.Members requiring connections are identified from design information and any potential or specified non standard connections are identified</p> <p>2.2.Design information is checked for specification of standard and non standard connections</p> <p>2.3.Adequacy of design information for non standard connections is checked and request for further information made if necessary</p> <p>2.4.Standard connections not specified by the designer are identified and connection type specified in conjunction with the fabricator</p> <p>2.5.Approval is sought from designer before detailing and fabrication</p>
3. Detail connections	<p>3.1.Connections suitable for standard detailing parameters are identified and detailed</p> <p>3.2.Connection components are detailed using standard detailing parameters</p> <p>3.3.Copes and notches are detailed for beams and columns as required</p> <p>3.4.Non standard connections are detailed according to supplied design information</p>
4. Detail purlin and girt cleats	<p>4.1.Purlins and girts are identified on design information</p> <p>4.2.Cleat length and bolt spacing is identified from purlin or girt manufacturer's instructions or design information</p> <p>4.3.Cleats are detailed</p>
5. Detail haunches for portal frame buildings	<p>5.1.Haunch specifications, bolting information, eave and apex information supplied by designer are checked</p> <p>5.2.Exact haunch sizes and dimension haunches on shop drawings and erection diagrams are calculated</p>



ELEMENT	PERFORMANCE CRITERIA
	5.3.Pre-sets for column tops are inserted into shop drawings and erection plans where specified in design information
6. Detail column base plates	6.1.Holding down bolt layout plan is prepared according to design information 6.2.Grouts and shims are specified for column base plates 6.3.Holding down bolts are specified from design information
7. Detail steel to non-steel connections	7.1.Edge clearances for concrete and other non-steel members or components are determined from designer or non-steel detailer 7.2.Casting plates types are identified from design information 7.3.Reinforcement locations are identified and clashes with connections avoided 7.4.Interference with post tensioning cables and holding down bolts is avoided for upper floor connections 7.5.Fixings are identified from design information 7.6.Steel to non-steel connections are detailed according to design information

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- assess design information for adequacy of information needed for structural steel detailing
- liaise with architects and engineers
- assess scope of structural steel detailing tasks and priorities
- interpret design drawings, sketches and schedules, to determine dimensions, layouts, types and grades of materials
- interpret manufacturers catalogues and product information
- use basic trigonometry to determine dimensions not given in design information
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual

**REQUIRED SKILLS AND KNOWLEDGE**

instructions

- communicate at all levels about technical issues related to patterns and specifications
- reading and numeracy is required to the level of interpreting workplace documents and technical information

**Required knowledge**

- architectural and engineering design drawings including standard symbols, terms, abbreviations and sketches
- connections used in structural steel construction
- the difference between design and detail drawing processes
- drawing office procedures
- fabrication processes and procedures
- the Australian steel structures limit state design code's (AS4100) requirements in so far as they impact on steel detailing
- characteristics of portal frame construction especially the behaviour of the frame under load and points of high stress

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment**

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**Critical aspects of for assessment and evidence required to demonstrate competency in this unit**

Demonstrates skills and knowledge to:

- identify and interpret architect and engineer design specifications for structural steel constructions including design information for steel to steel and steel to non-steel connections
- relate design information to structural steel detailing processes for connections
- establish efficient administrative arrangements for liaison with designers including arrangements for formal requests for further information
- establish drawing and document control procedures
- identify standard components and connections from industry publications, manufacturers' catalogues and

<b>EVIDENCE GUIDE</b>	
	Australian or other relevant standards
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment</p> <p>Resource implications for this unit include:</p> <ul style="list-style-type: none"> <li>• access to real or appropriately simulated detailing of structural steel connections including provision of suitable design information</li> <li>• computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment</li> <li>• access to steel and component manufacturers' catalogues or websites</li> <li>• access to relevant standards through either hard copy or internet access.</li> </ul> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>• Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>

<b>EVIDENCE GUIDE</b>	
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative/regulatory requirements</b>	All work must comply with relevant Federal and State or Territory legislative or regulatory requirements
<b>Connections</b>	All connections are steel to steel unless specifically noted
<b>Design information</b>	Design information is the information provided to the detailer and fabricator by the architects and consulting engineers for a project. For some projects the design information may only be provided by an engineer. The design information will usually be in the form of design drawings or sketches but may also be via material lists and written instructions and computer files
<b>Standard connections</b>	Standard connections are those specified in the Australian Steel Institute's publication <i>'Standardised Structural Connections'</i>
<b>Connection type</b>	<ul style="list-style-type: none"> <li>• Connections may be standard flexible or rigid connections</li> <li>• Flexible connections may include: <ul style="list-style-type: none"> <li>• angle seats</li> <li>• bearing pads</li> <li>• flexible end plates</li> </ul> </li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• angle cleats</li> <li>• web side plates</li> <li>• Rigid connections may include: <ul style="list-style-type: none"> <li>• fully welded end plates</li> <li>• bolted moment end plates</li> </ul> </li> </ul>
<b>Standard detailing parameters</b>	<p>Standard detailing parameters are connections suitable to be detailed using the standard bolting and welding specifications contained in the Australian Steel Institute's publication 'Standardised <i>Structural Connections</i>'. These details include:</p> <ul style="list-style-type: none"> <li>• size of fillet welds</li> <li>• electrode and MIG welding wire specification</li> <li>• bolt type and size</li> <li>• arrangement of holes for bolts</li> <li>• back gauge dimensions and minimum edge distances</li> <li>• distance from beam top to the first row of bolts</li> <li>• detailing parameters for components such as cleat plates, gussets, end plates, base plates and angle plates</li> </ul>
<b>Components</b>	Components may include cleat plates, gussets, end plates, base plates and angle plates
<b>Standard welding symbols</b>	Standard welding symbols as described in AS 1101 Part 3
<b>Non-steel connections</b>	<p>Non-steel connections are those between steel members and concrete, timber, glass or plastic or other building or fabricated component required to be shown on a structural steel detail drawing. The connection may be for structural or decorative purposes. An example would be steel supports for a timber deck</p>
<b>Haunch specifications</b>	<p>Haunches are special connections used in portal frame buildings. Haunch specifications supplied by designers will normally include:</p> <ul style="list-style-type: none"> <li>• roof slope</li> <li>• details of haunch location and size sufficient to ensure design requirements</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• end plate specification</li> <li>• bolting information</li> <li>• location and sizes of welds</li> <li>• fly bracing requirements</li> </ul>
<b>Fixings</b>	Fixings may include standard bolts, dynabolts, chemsets, female internal thread tube bolts, and other specialist steel to non-steel fixings
<b>Work environment</b>	<p>Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.</p> <p>Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper based and electronic instructions.</p>

## Unit Sector(s)

<b>Unit sector</b>	Structural steel detailing
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## Competency field

<b>Competency field</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## MSATCS502A Detail structural steel members

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to detail structural steel members in steel framed constructions. These members can include beams, girders, columns, trusses, rafters, rakers, tie beams and temporary and permanent braces.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a structural steel detailer who has to detail structural steel members used in steel constructions. These members can include beams, girders, columns, trusses and braces. Only the most common structural members are considered in this unit. However, the detailing principles and skills covered in this unit can usually be applied to any non standard members specified by designers.</p> <p>In this unit the term beam is interchangeable with the term girder and only 'beam' or 'beams' are used.</p> <p>The unit may apply to structural steel detailing carried out for residential, commercial, industrial or mining fabrication and construction projects. The detailing may be done manually or by using CAD and/or proprietary steel detailing software.</p> <p>The unit assumes that knowledge of basic technical drawing conventions and procedures such as view, dimensioning, drawing layout, etc. is already held.</p> <p>Work is conducted according to defined procedures.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p> <p>This unit requires the application of skills associated with</p>
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	planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	<i>MEM09002B</i>	<i>Interpret technical drawing</i>
	<i>MSATCS301A</i>	<i>Interpret architectural and engineering design specifications for structural steel detailing</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
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ELEMENT	PERFORMANCE CRITERIA
1. Detail beams	<p>1.1.Location and number of beams are identified from design information</p> <p>1.2.Beam direction marks are inserted according to industry practice or specific project needs</p> <p>1.3.Beam dimensions are obtained from design information and inserted into shop drawings</p> <p>1.4.Beam section designation and cut length are inserted into elevation detail and material list along with any general notes</p> <p>1.5.Beam levels and beam erection marks and erection clearances are inserted</p> <p>1.6.Any surface treatment notes are inserted as per design information</p>
2. Detail columns	<p>2.1.Timing and process for detailing of columns is discussed with fabricator to ensure suitability for fabrication schedules</p> <p>2.2.Column design information is analysed to identify all column connections</p> <p>2.3.Vertical or horizontal detailing position and viewing direction is elected to suit client requirements and drawing office practice</p> <p>2.4.Dimensions for columns are inserted from design information</p> <p>2.5.Sectional views for splices are drawn as per design information</p> <p>2.6.Plan views for intermediate sections are drawn to illustrate required connections</p> <p>2.7.Direction and level marks as well as shim and lifting hitches are inserted as required according to design information</p>
3. Detail beam and column splices	<p>3.1.Welded and bolted splices are identified from design information</p> <p>3.2.Splices to be field welded are identified and checked with fabricator</p> <p>3.3.Access for welder and electrode is considered for field welded splices</p> <p>3.4.Column or beam splice is detailed according to design information</p>
4. Detail trusses	<p>4.1.Working points and bevels are established from design information</p> <p>4.2.Layouts for joints are drawn using appropriate scale</p>

ELEMENT	PERFORMANCE CRITERIA
	<p>4.3.Opportunities for symmetry and rotation are noted and used in layouts with approval of fabricator</p> <p>4.4.Trusses are dimensioned including placement of working dimensions, intermediate panel points, other reference points and camber allowances for cambered trusses</p> <p>4.5.Bolted gussets for node points are set out using design information and fabricator preferences</p> <p>4.6.Node points for welded trusses are detailed including set back of member ends and landing for welds using design information and fabricator preferences</p>
5. Detail bracing	<p>5.1.Layout and size of bracing are determined from design information</p> <p>5.2.Setting out points and distances between setting out points are determined</p> <p>5.3.Braces are detailed including bracing connections, allowances for clearances and draw if any</p>
6. Detail purlins, girts and eaves struts	<p>6.1.Layout and type of purlins, girts and eave struts to be used is determined from design information, manufacturers' catalogues and fabricator preferences</p> <p>6.2.Bridging for purlins and girts is determined from design information</p> <p>6.3.Purlins, girts and eaves are detailed consistent with design information</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- assess design information for adequacy of information needed for structural steel detailing
- liaise with architects and engineers
- assess scope of structural steel detailing tasks and priorities
- interpret design drawings, sketches and schedules
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual

<b>REQUIRED SKILLS AND KNOWLEDGE</b>
<p>instructions</p> <ul style="list-style-type: none"> <li>• communicate at all levels about technical issues related to patterns and specifications</li> <li>• reading and numeracy is required to the level of interpreting workplace documents and technical information</li> </ul>
<b>Required knowledge</b>
<ul style="list-style-type: none"> <li>• architectural and engineering design drawings including standard symbols, terms, abbreviations and sketches</li> <li>• connections used in structural steel construction</li> <li>• the difference between design and detail drawing processes</li> <li>• drawing office procedures</li> <li>• fabrication processes and procedures</li> <li>• the Australian steel structures limit state design code's (AS4100) requirements in so far as they impact on steel detailing</li> </ul>

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
<p>The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.</p>	
<b>Overview of assessment</b>	
<b>Critical aspects of assessment and evidence required to demonstrate competency in this unit</b>	<p>Demonstrates skills and knowledge to:</p> <ul style="list-style-type: none"> <li>• identify and interpret architect and engineer design specifications for structural steel members and their connections</li> <li>• relate design information to detailing of structural steel members</li> <li>• establish efficient administrative arrangements for liaison with designers</li> <li>• establish drawing and document control procedures</li> <li>• identify standard components and connections from industry publications, manufacturers' catalogues and Australian or other relevant standards</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment</p>

<b>EVIDENCE GUIDE</b>	
	<p>Resource implications for this unit include:</p> <ul style="list-style-type: none"> <li>• access to real or appropriately simulated detailing of structural steel members including provision of suitable design information</li> <li>• computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment</li> <li>• access to steel and component manufacturers' catalogues or websites</li> <li>• access to relevant standards through either hard copy or internet access.</li> </ul> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>• Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being</p>

**EVIDENCE GUIDE**

performed.

**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Legislative/regulatory requirements**

All work must comply with relevant Federal and State or Territory legislative or regulatory requirements

**Design information**

Design information is the information provided to the detailer and fabricator by the architects and consulting engineers for a project. For some projects the design information may only be provided by an engineer. The design information will usually be in the form of design drawings or sketches but may also be via material lists, written instructions or computer files

**Direction marks**

Direction marks are indicated on the shop drawings and on the beam or girder by the words 'North' or 'West' as applicable. Industry standard practice is to determine the placement of these marks by viewing and numbering the beams and girders from the bottom or right hand edge of the floor plan. Variations from this practice may occur on specific projects and should be noted on the erection plan

**Beam dimensions**

Beam dimensions are obtained from design information in conjunction with Design Capacity Tables (see below) and manufacturers' catalogues. Beam dimensions to be inserted into shop drawings should include:

- longitudinal dimensions
  - centre to centre distance between supports

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• overall length of the beam</li> <li>• overall cut length of the beam</li> <li>• dimensions of holing and other details occurring along the length of the beam. The method of showing hole dimensions may be centre to centre, consecutively from end to end of beam or as running dimensions according to the needs of the fabricator</li> <li>• longitudinal dimensions to groups of holes in the web or flange</li> <li>• vertical dimensions to top most holes for end connection elements</li> </ul> <p>Additional dimensions and symbols may be required for non-proprietary welded plate girders. These dimensions and symbols would be specified by the designer and would normally include web and flange dimensions, web stiffener locations and welding symbols</p>
<b>Working points</b>	Working points for trusses may also be referred to as setting out points or intersection points
<b>Design Capacity Tables</b>	Design Capacity Tables refers to the publication 'Design Capacity Tables for Structural Steel, Volume 1: Open Sections' published by the Australian Steel Institute
<b>Connections</b>	All connections are steel to steel unless specifically noted
<b>Standard connections</b>	Standard connections are those specified in the Australian Steel Institute's publication 'Standardised Structural Connections'
<b>Connection type</b>	<ul style="list-style-type: none"> <li>• Connections may be standard flexible or rigid connections</li> <li>• Flexible connections may include: <ul style="list-style-type: none"> <li>• angle seats</li> <li>• bearing pads</li> <li>• flexible end plates</li> <li>• angle cleats</li> <li>• web side plates</li> </ul> </li> <li>• Rigid connections may include:</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• fully welded end plates</li> <li>• bolted moment end plates</li> </ul>
<b>Standard detailing parameters</b>	<p>Standard detailing parameters are connections suitable to be detailed using the standard bolting and welding specifications contained in the Australian Steel Institute's publication 'Standardised <i>Structural Connections</i>'. These details include:</p> <ul style="list-style-type: none"> <li>• size of fillet welds</li> <li>• electrode and MIG welding wire specification</li> <li>• bolt type and size</li> <li>• arrangement of holes for bolts</li> <li>• back gauge dimensions and minimum edge distances</li> <li>• distance from beam top to the first row of bolts</li> <li>• detailing parameters for components such as cleat plates, gussets, end plates, base plates and angle plates</li> </ul>
<b>Components</b>	Components may include cleat plates, gussets, end plates, base plates and angle plates
<b>Standard welding symbols</b>	Standard welding symbols as described in AS 1101 Part 3
<b>Non-steel connections</b>	<p>Non-steel connections are those between steel members and concrete, timber, glass or plastic or other building or fabricated component required to be shown on a structural steel detail drawing. The connection may be for structural or decorative purposes. An example would be steel supports for a timber deck</p>
<b>Fixings</b>	Fixings may include standard bolts, dynabolts, chemsets, female internal thread tube bolts, and other specialist steel to non-steel fixings
<b>Work environment</b>	<p>Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.</p> <p>Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper</p>

**RANGE STATEMENT**

	based and electronic instructions.
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**Unit Sector(s)**

<b>Unit sector</b>	Structural steel detailing
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		



## **MSATCS503A Incorporate structural steel detailing into fabrication and construction project management**

### **Modification History**

Not applicable.

### **Unit Descriptor**

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to undertake structural steel detailing in a manner consistent with procedures and timelines for fabrication and construction projects. The unit requires knowledge of the roles of architects, engineers, builders and fabricators and the skill to interpret project schedules and timelines and their implications for structural steel detailing.
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### **Application of the Unit**

<b>Application of the unit</b>	<p>This unit applies to structural steel detailers who are required to liaise with architects, consulting engineers, builders and fabricators at the commencement of a project to establish structural steel detailing arrangements that are consistent with the policies, procedures and timelines of fabrication or construction projects. The unit may apply to structural steel detailing carried out for residential, commercial, industrial or mining projects.</p> <p>Work is conducted according to defined procedures.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p> <p>This unit requires the application of skills associated with planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Demonstrate knowledge of steel construction and fabrication processes and roles	1.1. Steel construction stages of design, detailing, fabrication and erection are understood 1.2. Major codes and standards relevant to steel construction activities can be identified 1.3. Roles and responsibilities of architects, engineers, draftspersons and detailers, fabricators and builders can be explained
2. Determine client requirements for structural steel detailing	2.1. Client for structural steel detailing is determined 2.2. Contacts for architect, consulting engineer, builder and fabricator are obtained 2.3. Project timeline and schedules are obtained and

ELEMENT	PERFORMANCE CRITERIA
	<p>delivery dates for detail drawings determined</p> <p>2.4.Procedures for making requests for further information (RFIs) from designers are agreed</p> <p>2.5.Requirements for attendance at team meetings and site visits are determined</p> <p>2.6.Client requirements in relation to format, number and type of shop and erection drawings and other required detailing information is determined</p>
3. Obtain design information for project	<p>3.1.Design information is obtained from architect and consulting engineer</p> <p>3.2.Design information and project schedules are used to assess the scope and complexity of detailing tasks</p>
4. Establish structural steel detailing arrangements for project	<p>4.1.Details of structural steel detailing team are communicated to client</p> <p>4.2.Document control procedures including numbering, access, filing and revision and updating approval procedures are established according to enterprise procedures and client requirements</p> <p>4.3.Steel detailing tasks and deadlines are established and checked against construction project schedules</p> <p>4.4.Capabilities of proprietary CAD and steel detailing software for project is assessed and decision is made to use computer based or manual structural detailing methods</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- communicate own and team capabilities
- negotiate with clients
- assess scope of structural steel detailing tasks and priorities
- use Gantt charts and other project management scheduling tools
- assess suitability of specialist software for particular steel detailing projects
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual

## REQUIRED SKILLS AND KNOWLEDGE

instructions

- communicate at all levels about technical issues related to patterns and specifications
- reading and numeracy is required to the level of interpreting workplace documents and technical information

### Required knowledge

- roles and responsibilities of owners, architects, engineers, fabricators, builders and structural steel detailers in construction projects
- construction and fabrication project management practices including use of Gannt charts and other scheduling tools
- difference between design and detail drawing processes
- drawing office procedures
- proprietary and non-proprietary CAD and specialist steel detailing programs

## Evidence Guide

### EVIDENCE GUIDE

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

#### Overview of assessment

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

Demonstrates skills and knowledge to:

- identify client and design requirements for a structural steel detailing project
- establish structural steel detailing task schedule and timelines and integrate them into the broader project plan and timelines
- establish efficient administrative arrangements for liaison with clients and designers
- establish drawing and document control procedures

#### Context of and specific resources for assessment

Assessment may occur on the job or in an appropriately simulated environment

Resource implications for this unit include:

- access to real or appropriately simulated detailing of structural steelwork constructions including provision of suitable design information

## EVIDENCE GUIDE

	<ul style="list-style-type: none"> <li>• access to real or simulated fabrication and construction schedules</li> <li>• computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment</li> <li>• access to steel and component manufacturers catalogues or web sites</li> <li>• access to relevant standards through either hard copy or internet access.</li> </ul> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</li> <li>• Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.</p>

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative/regulatory requirements</b>	All work must comply with relevant Federal and State or Territory legislative or regulatory requirements
<b>Client</b>	The term client in this unit refers to the organisation commissioning the production of structural steel detail drawings and will normally be the fabricator of structural steel elements of a construction project. However, depending on the project the client may vary and could be the consulting engineer, or in the case of mining projects, it could be the mining company. The client may commission structural steel detail drawing from either internal or external structural steel detailers
<b>Schedules</b>	Schedules may include Gantt charts, contract schedules, lists of contractors, contracted suppliers and any other lists or diagrams relevant to determining the required delivery dates for structural steel detail drawings
<b>Client requirements</b>	<p>Client requirements may include:</p> <ul style="list-style-type: none"> <li>• shop detail drawings, erection diagrams and material schedules and lists</li> <li>• program and format for CAD files and models</li> <li>• downloading by the structural steel detailer of files direct to client computers and CNC machines</li> <li>• size and number of hard copy drawings</li> <li>• specification of programs and requirements for word processed documents, spreadsheets, presentations, invoices and so on</li> </ul>

## RANGE STATEMENT

<b>Design information</b>	Design information is the information provided to the detailer and fabricator by the architects and consulting engineers for a project. For some projects the design information may only be provided by an engineer. The design information will usually be in the form of design drawings or sketches but may also be via material lists and written instructions.
<b>Work environment</b>	Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.  Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper based and electronic instructions.

## Unit Sector(s)

<b>Unit sector</b>	Structural steel detailing
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## Competency field

<b>Competency field</b>	
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## Co-requisite units

<b>Co-requisite units</b>		

## MSATCS504A Detail ancillary steelwork

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit covers the skills and knowledge required to detail steelwork ancillary to, or separate from, the main structural elements and their connections in a steel framed building or industrial construction.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit applies to a structural steel detailer who has to detail ancillary structural steelwork including steelwork used in stairways, ladders, landings, platforms for personnel and machinery, and other ancillary steel structures such as cages, lift guide rails and crane rails. The unit can also apply to the detailing of stand alone steel constructions that are not part of or attached to plant or buildings, and which do not require additional specialist knowledge. Examples include:</p> <ul style="list-style-type: none"><li>• steel tankage rolled plates</li><li>• chimney flumes</li><li>• exhaust pipe flumes</li><li>• pipe supports</li><li>• conveyor structures.</li></ul> <p>The unit assumes that knowledge of basic technical drawing conventions and procedures such as view, dimensioning, drawing layout, and so on is already held.</p> <p>Work is conducted according to defined procedures.</p> <p>The detailing covered by this unit may be done manually or by using CAD and/or proprietary steel detailing software.</p> <p>Work may be conducted in small to large scale enterprises and may involve individual and team activities.</p>
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	This unit requires the application of skills associated with planning and organising to complete structural steel detail drawings. Communication and numeracy skills are used to refer to patterns and specifications and complete and label sketches. Self management skills are used to ensure conformance of own work to quality standards.
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>	<i>MEM09002B</i>	<i>Interpret technical drawing</i>
	<i>MSATCS301A</i>	<i>Interpret architectural and engineering design specifications for structural steel detailing</i>

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
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ELEMENT	PERFORMANCE CRITERIA
1. Detail stairways, platforms, ladders and landings	<p>1.1.Scheduling of detail drawings for stairways, platforms, ladders and landings are discussed with fabricator</p> <p>1.2.Design information is checked and any requests for further information (RFIs) are made</p> <p>1.3.Large scale set-out or 3D model of stairway is prepared and setting out points established</p> <p>1.4.Stairway is dimensioned and detailed consistent with design information and the Building Code of Australia and AS 1657</p> <p>1.5.Holding down bolt layout and base plate details are prepared for ground floor supports or plinths</p>
2. Detail other ancillary steel structures	<p>2.1.Design information is received from client and fabrication schedule and requirements including allocation of components for shop and site fabrication confirmed</p> <p>2.2.Size limitations of any sections requiring corrosion treatment or other surface finishing processes are determined</p> <p>2.3.Transport limitations, erection procedures and limitations, and any relevant codes and regulations are determined</p> <p>2.4.Rough large scale layout and 3D model is combined with trial assembly if required</p> <p>2.5.Design information is used to directly insert or calculate and insert all dimensions, clearances, bolt layouts, weld types and dimensions, direction marks and surface finishes on shop drawings and erection diagrams</p> <p>2.6.Detail drawings are sent for approval by designer</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

- assess design information for adequacy of information needed for structural steel detailing

**REQUIRED SKILLS AND KNOWLEDGE**

- liaise with architects and engineers
- assess scope of structural steel detailing tasks and priorities
- interpret design drawings, sketches and schedules
- produce shop detail drawings and erection drawings
- research and obtain relevant Australian Standards, codes and regulations
- work according to OHS practices of the enterprise and workplace which may include requirements prescribed by legislation, awards, agreements and conditions of employment, standard operating procedures, or oral, written or visual instructions
- communicate at all levels about technical issues related to patterns and specifications
- reading and numeracy is required to the level of interpreting workplace documents and technical information

**Required knowledge**

- architectural and engineering design drawings including standard symbols, terms, abbreviations and sketches
- structural members used in steel constructions
- the difference between design and detail drawing processes
- drawing office procedures
- fabrication processes and procedures
- the Australian steel structures limit state design code's (AS4100) requirements in so far as they impact on steel detailing

**Evidence Guide****EVIDENCE GUIDE**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

**Overview of assessment****Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Demonstrates skills and knowledge to:

- identify and interpret architect and engineer design specifications for structural steel components of ancillary steelwork including members and connections
- relate design information to structural steel detailing processes

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• establish efficient administrative arrangements for liaison with designers</li> <li>• establish drawing and document control procedures</li> <li>• identify standard sizes and specifications of structural members and components from industry publications, manufacturers' catalogues and Australian or other relevant standards</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment may occur on the job or in an appropriately simulated environment</p> <p>Resource implications for this unit include:</p> <ul style="list-style-type: none"> <li>• access to real or appropriately simulated detailing of ancillary structural steelwork including provision of suitable design information</li> <li>• computer with suitable CAD software or manual drafting equipment and material including work areas, materials and equipment</li> <li>• access to steel and component manufacturers catalogues or web sites</li> <li>• access to relevant standards through either hard copy or internet access.</li> </ul> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.</p>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed assessment guidelines of the Manufacturing Training Package</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge</li> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application</li> <li>• Assessment may be applied under project related conditions (real or simulated) and require evidence of process</li> <li>• Assessment must confirm a reasonable inference that</li> </ul>

<b>EVIDENCE GUIDE</b>	
	<p>competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances</p> <ul style="list-style-type: none"> <li>Assessment may be in conjunction with assessment of other units of competency where structural steel detailing is involved</li> </ul>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

## Range Statement

<b>RANGE STATEMENT</b>	
<p>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.</p>	
<b>Legislative/regulatory requirements</b>	All work must comply with relevant Federal and State or Territory legislative or regulatory requirements
<b>Design information</b>	Design information is the information provided to the detailer and fabricator by the architects and consulting engineers for a project. For some projects the design information may only be provided by an engineer. The design information will usually be in the form of design drawings or sketches but may also be via material lists, written instructions and computer files
<b>Other ancillary steel structures</b>	<p>Other ancillary structures as defined in this unit are steel constructions that are not part of the structural framework or exterior of a building or part of the structural support for plant and which could be part of a steel construction detailing contract. Examples include:</p> <ul style="list-style-type: none"> <li>crane rails and connections</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• lift guide rails</li> <li>• cages</li> <li>• steel tankage rolled plates</li> <li>• chimney flumes</li> <li>• exhaust pipe flumes</li> <li>• pipe supports</li> <li>• conveyor structures</li> </ul>
<b>Direction marks</b>	<p>Direction marks are indicated on the shop drawings and on the beam or girder by the words 'North' or 'West' as applicable. Industry standard practice is to determine the placement of these marks by viewing and numbering the beams and girders from the bottom or right hand edge of the floor plan. Variations from this practice may occur on specific projects and should be noted on the erection plan.</p>
<b>Work environment</b>	<p>Detailing may be undertaken in a variety of work environments including commercial, home office or fabrication or construction enterprise.</p> <p>Work may be performed individually on a contracting/project basis or as part of a project team and in response to combinations of paper based and electronic instructions.</p>

## Unit Sector(s)

<b>Unit sector</b>	Structural steel detailing
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## Competency field

<b>Competency field</b>	
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## Co-requisite units

Co-requisite units		

## MSL976003A Evaluate and select appropriate test methods and/or procedures

### Modification History

Not applicable.

### Unit Descriptor

<b>Unit descriptor</b>	This unit of competency covers the ability to evaluate and select test methods and/or procedures that are relevant to the current and evolving scope of the laboratory's operations. Selection of test methods and/or procedures may involve the appraisal of new and emerging technologies and may inform decision making about possible extension of the laboratory's scope. Alternatively, it may relate to existing testing requirements, 'one-off' tests, client's special requirements or new tests required to satisfy new legislative, accreditation, licensing or regulatory requirements.
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### Application of the Unit

<b>Application of the unit</b>	<p>This unit of competency is applicable to senior technical officers, technical specialists and laboratory supervisors working in all industry sectors. They are required to demonstrate wide ranging, highly specialised technical skills. They are expected to execute sound judgement in the selection of appropriate methodology under the broad guidance of scientists/medical staff/engineers. All operations must comply with relevant standards, appropriate procedures and/or enterprise requirements.</p> <p>Industry representatives have provided case studies to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting. These can be found at the end of this unit of competency under the section 'This competency in practice'.</p>
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

<b>Prerequisite units</b>		

## Employability Skills Information

<b>Employability skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine sample characteristics and testing requirements	<ul style="list-style-type: none"><li>1.1. Confirm drivers for evaluation and selection of test methods and/or procedures</li><li>1.2. Examine sample documentation and/or consult with sample supplier to determine nature of samples</li><li>1.3. Identify sample characteristics which may affect testing requirements</li><li>1.4. Determine testing requirements and their compatibility with existing standard operating procedures (SOPs)</li></ul>

ELEMENT	PERFORMANCE CRITERIA
2. Evaluate possible test methods and/or procedures	<ul style="list-style-type: none"><li>2.1. Identify appropriate standards, reference materials, test methods and/or procedures which may be applicable</li><li>2.2. Assess suitability of available standards, reference materials, test methods and/or procedures against testing requirements</li><li>2.3. Identify environmental and occupational health and safety (OHS) risks</li><li>2.4. Identify the need for specific equipment, instrumentation, and/or specialised facilities</li><li>2.5. Estimate materials, personnel and possible training requirements</li></ul>
3. Recommend appropriate test methods and/or procedures	<ul style="list-style-type: none"><li>3.1. Select appropriate test methodology consistent with testing requirements and resource availability</li><li>3.2. Identify any changes to SOPs required prior to implementation of selected method and/or procedure</li><li>3.3. Recommend selected method and/or procedure to appropriate personnel and seek authorisation to proceed</li></ul>
4. Confirm and document selected methods and/or procedures	<ul style="list-style-type: none"><li>4.1. Obtain standards and/or reference materials for the method and/or procedure</li><li>4.2. Conduct tests to verify the performance of the method and/or procedure, standards and reference materials</li><li>4.3. Analyse the measurements and estimate uncertainties</li><li>4.4. Determine if legal traceability is required and develop appropriate chain of custody procedures</li><li>4.5. Document all safety, sample preparation, testing, data handling and reporting procedures</li><li>4.6. Submit all documentation to appropriate personnel for review and approval</li></ul>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit.

#### Required skills

**REQUIRED SKILLS AND KNOWLEDGE**

Required skills include:

- evaluating and selecting appropriate test methods and/or procedures to satisfy the range of testing situations normally encountered in the laboratory
- identifying reference standards or SOPs appropriate to testing requirements of the laboratory
- identifying standards that support compliance with regulatory and/or licensing requirements
- applying enterprise procedures to select appropriate standards
- using method performance analysis measures, such as accuracy, precision, uncertainty, linearity, selectivity, range, limit of detection and matrix characteristics in method selection
- documenting method selection procedures
- maintaining records of published methods
- following OHS procedures and principles of good laboratory practice (GLP)

**Required knowledge**

Required knowledge includes:

- principles, concepts and enterprise/regulatory requirements related to method selection
- regulatory/licensing testing requirements
- relative advantages/disadvantages of test methods for a range of testing situations
- cost advantages/disadvantages of enterprise test methods
- scientific/technical principles underpinning test method and their application to selection of testing methods for different materials
- metrological principles
- significance of normal, physiological or reference ranges
- enterprise and/or legal requirements for traceability
- enterprise/regulatory requirements regarding recording and reporting
- relevant health, safety and environment requirements

**Specific industry**

Additional knowledge requirements may apply for different industry sectors. For example:

Biomedical, biotechnology and food processing:

- effects of biologically inert or active chemicals, such as food and drug metabolites in test selection, testing and test data interpretation

## Evidence Guide

<b>EVIDENCE GUIDE</b>	
The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.	
<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>Assessors should ensure that candidates can:</p> <ul style="list-style-type: none"> <li>• evaluate and select appropriate test methods and/or procedures to satisfy the range of testing situations normally encountered in the laboratory</li> <li>• identify reference standards or SOPs appropriate to testing requirements of the laboratory</li> <li>• identify standards that support compliance with regulatory and/or licensing requirements</li> <li>• apply enterprise procedures to select appropriate standards</li> <li>• use method performance measures, such as accuracy, precision, uncertainty, linearity, selectivity, range, limit of detection and matrix characteristics in method selection</li> <li>• clearly document method selection procedures</li> <li>• maintain records of published methods</li> <li>• follow OHS procedures and principles of GLP.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>This unit of competency is to be assessed in the workplace or simulated workplace environment.</p> <p>This unit of competency may be assessed with:</p> <ul style="list-style-type: none"> <li>• <i>MSL925002A Analyse measurements and estimate uncertainties</i></li> <li>• <i>MSL916003A Supervise laboratory operations in work/functional area.</i></li> </ul> <p>Resources may include:</p> <ul style="list-style-type: none"> <li>• standard laboratory equipped with appropriate equipment and reagents</li> <li>• SOPs and test methods</li> <li>• appropriate Australian and international regulatory standards.</li> </ul>
<b>Method of assessment</b>	<p>The following assessment methods are suggested:</p> <ul style="list-style-type: none"> <li>• completion of selection brief or selection proficiency test</li> </ul>

**EVIDENCE GUIDE**

	<ul style="list-style-type: none"> <li>• review of records completed by the candidate over a period of time to confirm consistency in method selection</li> <li>• feedback from peers and supervisors</li> <li>• oral questioning to establish basis of selection of test methods and/or procedures.</li> </ul> <p>In all cases, practical assessment should be supported by questions to assess underpinning knowledge and those aspects of competency which are difficult to assess directly.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p> <p>Access must be provided to appropriate learning and/or assessment support when required.</p> <p>The language, literacy and numeracy demands of assessment should not be greater than those required to undertake the unit of competency in a work like environment.</p>
<b>This competency in practice</b>	<p>Industry representatives have provided the case studies below to illustrate the practical application of this unit of competency and to show its relevance in a workplace setting.</p> <p><b>Biotechnology</b></p> <p>The choice of analytical method for protein assay is influenced by the amount of protein likely to be present and the impurities present. During an extraction procedure, the yield of protein is monitored. At any stage there will be a range of substances used in the extraction. When the extraction is complete and the protein required has been isolated, the amount of protein recovered could range from bulk or gram quantities down to microgram quantities. The technical officer will check through the available methodologies and select procedures that will take account of the above problems. The Biuret assay is used for bulk assay protein, but will require reagent blanks to compensate for the impurities. At later stages of the monitoring, the Bradford reagent will be chosen because of its greater sensitivity and detection of smaller concentrations. It will be chosen over the Folin's reagent because the Bradford reagent is not affected by buffer</p>

**EVIDENCE GUIDE**

	<p>reagents and detergent.</p> <p><b>Biomedical</b></p> <p>A technician is asked to detect, identify and quantify a blood group antibody using a range of physical, chemical and immunological tests. During the test evaluation and selection process he/she identifies performance parameters, such as test tolerance, sensitivity, specificity and reproducibility along with the effect of possible interfering serum pigments, such as dissolved haemoglobin and bilirubin. The technician prepares a report for the supervising scientist that explains the selection rationale, reports the performance test results and cites product information and recent literature to validate the test results and substantiate his/her conclusions and recommendations.</p> <p><b>Food processing</b></p> <p>A technician working in a food company must be able to select test methods appropriate to requirements. For example, if a quick determination of unsaturation in an oil mixture is required, the technician will probably use an appropriate method for determining the iodine value of the mix and compare this with specification. However, at a margarine manufacturing plant where the technician may be required to perform an analysis of fats and oils to determine the % saturated, % monounsaturated and % polyunsaturated components, then a gas chromatographic method would be run using appropriate computer software and the results checked against specification.</p>
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**Range Statement****RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

**Codes of practice**

Where reference is made to industry codes of practice, and/or Australian/international standards,

<b>RANGE STATEMENT</b>	
	it is expected the latest version will be used
<b>Standards, codes, procedures and/or enterprise requirements</b>	<p>Standards, codes, procedures and/or enterprise requirements may include:</p> <ul style="list-style-type: none"> <li>• Australian and international standards, such as:</li> <li>• AS ISO 1000-1998 The international system of units (SI) and its application</li> <li>• AS ISO 17025-2005 General requirements for the competence of testing and calibration laboratories</li> <li>• AS/NZS 2243 Set:2006 Safety in laboratories set</li> <li>• AS/NZS ISO 10005:2006 Quality management systems - Guidelines for quality plans</li> <li>• AS/NZS ISO 10012:2004 Measurement management systems - Requirements for measurement processes and measuring equipment</li> <li>• AS/NZS ISO 14000 Set:2005 Environmental management standards set</li> <li>• AS/NZS ISO 9000 Set:2008 Quality management systems set</li> <li>• ISO 5725 Accuracy (trueness and precision) of measurement methods and results</li> <li>• ISO/IEC Guide 98-3:2008 Uncertainty of measurement - Part 3 Guide to the expression of uncertainty in measurement (GUM)</li> <li>• Eurachem/CITAC Guide CG4 Quantifying uncertainty in analytical measurement</li> <li>• Australia New Zealand Food Standards (ANZFS) Code</li> <li>• Australian code of good manufacturing practice for medicinal products (GMP)</li> <li>• Australian Dangerous Goods Code</li> <li>• Australian Quarantine and Inspection Service (AQIS) Export Control (Orders) Regulations 1982 and Import Guidelines</li> <li>• ethics committee requirements</li> <li>• gene technology regulations</li> <li>• intellectual property and copy right</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• material safety data sheets (MSDS)</li> <li>• material, production and product specifications</li> <li>• National Association of Testing Authorities (NATA) Accreditation programs requirements</li> <li>• national environment protection measures</li> <li>• National Health and Medical Research Council (NHMRC) Guidelines</li> <li>• national measurement regulations and guidelines</li> <li>• OHS national standards and codes of practice</li> <li>• principles of GLP</li> <li>• quality manuals, equipment and procedures manuals</li> <li>• Therapeutic Goods Regulations 1009</li> </ul>
<b>Tests and procedures</b>	<p>Tests and procedures may be:</p> <ul style="list-style-type: none"> <li>• routine</li> <li>• infrequent</li> <li>• 'one-off'</li> <li>• quantitative or qualitative</li> <li>• identification or quantification of biological, chemical or physical activity</li> <li>• gross characteristics of a sample, including in vitro and in vivo</li> <li>• detection of chemical, physical or biological characteristics, features, markers or responses</li> </ul>
<b>Drivers for the evaluation and selection of test methods and/or procedures</b>	<p>Drivers for the evaluation and selection of test methods and/or procedures may include the:</p> <ul style="list-style-type: none"> <li>• new or amended legislation, regulation and licensing, accreditation requirements</li> <li>• public, political and commercial pressures</li> <li>• 'one-off' testing of potentially hazardous or contaminated materials following an environmental emergency or incident</li> <li>• introduction of new reference standards, new or modified equipment and instruments</li> <li>• introduction of commercial products that are potentially hazardous</li> <li>• control of new, or changed, starting materials, in-process materials and products</li> <li>• troubleshooting of production, environmental and public health issues</li> </ul>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• environmental monitoring of new sites</li> <li>• investigation of customer's complaints</li> <li>• specialised testing of forensic, medical or veterinary samples</li> <li>• need to meet customer specific or changed requirements</li> <li>• development of new products</li> </ul>
<b>Factors which may influence method evaluation and selection</b>	<p>Factors which may influence method evaluation and selection</p> <ul style="list-style-type: none"> <li>• quantity and nature of sample available for testing</li> <li>• levels of detection required</li> <li>• type of matrix, possible contaminants and resulting interference</li> <li>• safety</li> <li>• availability of suitable equipment, instruments and availability of trained staff</li> <li>• cost</li> <li>• selectivity of method, range, accuracy, precision and acceptable uncertainty</li> <li>• whether it is appropriate/ethical to perform the test</li> <li>• balancing customer, enterprise and/or regulatory/licensing requirements</li> </ul>
<b>Occupational health and safety (OHS) and environmental management requirements</b>	<p>OHS and environmental management requirements:</p> <ul style="list-style-type: none"> <li>• all operations must comply with enterprise OHS and environmental management requirements, which may be imposed through state/territory or federal legislation - these requirements must not be compromised at any time</li> <li>• all operations assume the potentially hazardous nature of samples and require standard precautions to be applied</li> <li>• where relevant, users should access and apply current industry understanding of infection control issued by the National Health and Medical Research Council (NHMRC) and State and Territory Departments of Health</li> </ul>

**Unit Sector(s)**

<b>Unit sector</b>	Testing
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**Competency field**

<b>Competency field</b>	
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**Co-requisite units**

<b>Co-requisite units</b>		

## **MSS402002A Sustain process improvements**

### **Modification History**

New unit, superseding MSACMS201A Sustain process improvements - Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to prevent process improvements in their own work from slipping back to former practices or digressing to less efficient practices.

### **Application of the Unit**

This unit applies to organisations implementing competitive systems and practices and continuous improvement. It covers the skills needed to ensure that process improvements are sustained and opportunities taken to suggest further improvements.

Improvement initiatives can be made by any of a number of methods and by teams or individuals. The unit assumes that desired levels of performance or quality are known to employees.

The unit can be applied to all areas of an organisation, including production, maintenance, logistics and office functions.

This unit requires the application of skills associated with problem solving, initiative and enterprise and self-management in order to understand implement and monitor improvement practices. It also requires the ability to identify and address personal skill gaps in order to manage own ability to implement change.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Examine previous improvements	1.1	Identify impact of previous process improvements to equipment, operations, services or products in own work area
		1.2	Identify improvements where objectives have not been met
2	Implement corrective actions	2.1	Identify corrective actions that can be taken by self on process improvements that have not met objectives
		2.2	Obtain any required approvals
		2.3	Identify any additional, personal skill gaps and seek skill development
		2.4	Adopt improved processes
3	Check changes	3.1	Identify claimed improvements
		3.2	Identify methods of observing and measuring claimed improvements in own work area
		3.3	Check if claimed improvements are occurring and report problems in accordance with procedures
4	Check for further improvements	4.1	Look for areas of possible further improvement
		4.2	Discuss further improvements with peers and supervisors
		4.3	Take action to implement improvements in accordance with procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others to clarify scope and stage of implementation of competitive systems and practices and contribute suggestions for further improvements in implementation
- visualising normal operational procedures in terms of flow and contribution to customer outcomes
- planning own tasks to support competitive systems and practices implementation
- implementing competitive systems and practices in own work area according to instructions
- identifying waste (muda)
- monitoring competitive systems and practices performance indicators in own work and work area

### Required knowledge

Required knowledge includes:

- internal and external customers and the value they derive from own work area operations
- suppliers to own work area, their capabilities and contribution to customer benefit
- waste (muda)
- relevant competitive systems and practices for own job and how to apply and monitor the outcomes
- factors impacting on product, operations and waste, particularly those wholly or partially under their control (and how to control them)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person being assessed against this unit will be able to demonstrate their willing adoption of new equipment, processes, procedures and practices as well as their
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	expertise at implementing them and making critical reviews of their performance in line with their level of competence and authority.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• implement and monitor process improvements in own work area against objectives</li> <li>• contribute suggestions for further improvement/s</li> <li>• apply procedures for seeking approvals and reporting non-conformances.</li> </ul>
Context of and specific resources for assessment	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
Method of assessment	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made</p>

	to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> </ul>
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	<ul style="list-style-type: none"> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and industry sector</li> </ul>
<b>Customers</b>	<p>Customers may be:</p> <ul style="list-style-type: none"> <li>• internal or external customers and should be sufficiently close to the individual's work as to be easily identifiable</li> <li>• final customers used as the basis for the identification of value and waste</li> </ul> <p>The individual does not need to interface directly with the external customer, but should be provided with sufficient information to enable them to identify customer benefits and customer features</p>
<b>Suppliers</b>	<p>Suppliers may be:</p> <ul style="list-style-type: none"> <li>• internal or external suppliers and should be sufficiently close to the individual's work as to be easily identifiable</li> </ul> <p>The operator does not need to interface directly with external suppliers, but should be provided with sufficient information to enable them to identify supplier contribution to their own work and to customer benefit</p>
<b>Measuring improvements</b>	<p>Measuring improvements may include:</p> <ul style="list-style-type: none"> <li>• personally taking measurements</li> <li>• arranging for measurements to be taken/made by appropriate personnel</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipe</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing</li> </ul>



	<p>practice (GMP) and responsible care) and government regulations</p> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer-based or in some other format</li></ul>
<b>Improvements</b>	<p>Improvements include:</p> <ul style="list-style-type: none"><li>• techniques for preventing mistakes by designing the operations process, equipment and tools so that an operation literally cannot be performed incorrectly (e.g. baka-yoke)</li><li>• techniques that generate warning signals were a mistake is about to be performed (poka-yoke)</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS402030A Apply cost factors to work practices

### Modification History

New unit, superseding MSACMT230A Apply cost factors to work practices - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required by an individual to identify cost components in their work and to be able to determine, in general terms, the cost impacts of alternative actions.

### Application of the Unit

This unit applies to an individual who is required to contribute to, and be involved in, the assessment of cost factors in their work. This may be done individually or in a team environment.

The unit covers the skills to be able to assess the relative costs of the alternatives and use this as one of the key factors in making decisions. Decisions are made within the scope of the employee's authority and according to procedures. Typical decisions include those that contribute to the efficient organisation of own work and the improvement of production time and cycle times.

This unit requires the application of skills associated with problem solving to identify cost factors and cost implications of own work and self-management to apply cost-effective practices.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised
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unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify the major cost components of product or process in own work area	1.1	Identify cost components in the product or process in own work area
		1.2	Recognise the impact of current or alternative actions on costs
2	Identify constraints to cost-efficiency	2.1	Identify required production/process rate and major costs
		2.2	Identify costs factors under individual or team control
		2.3	Relate identified costs factors to impact on overall cost of production/process
		2.4	Identify cost factors that are a constraint to cost-efficiency in own work area
3	Apply cost-efficient work practices	3.1	Identify and explain to relevant people the implications of possible actions/changes to improve cost-efficiency in simple financial terms
		3.2	Identify non-financial implications of proposed changes in discussion with relevant people
		3.3	Select actions which minimise overall costs
		3.4	Monitor actions to ensure cost-efficiency in own work area is maintained

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others to clarify cost factors and contribute suggestions for improvement
- visualising normal operational procedures in terms of flow
- distinguishing between fixed and variable costs
- identifying fixed and variable cost components relevant to own work, including where applicable:
  - power/energy
  - materials, plant and equipment
  - production or process time, including impact on salary and wages
  - office expenses
  - government taxes and charges

### Required knowledge

Required knowledge includes:

- cost components of products made
- costs concepts, such as expense and income
- major cost contributors to product (e.g. energy)
- the difference between internally and externally controlled costs
- difference between overhead, labour and consumables

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• identify the scope of their own and their teams work and relate it to the overall flow of work in the organisation</li><li>• express cost factors in specific terms (e.g. cost per</li></ul>
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	<p>item, process and task) and not just in a general manner</p> <ul style="list-style-type: none"> <li>• identify and express costs factors in simple financial terms</li> <li>• use cost factors to select lower cost alternatives when making decisions.</li> </ul>
Context of and specific resources for assessment	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
Method of assessment	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
Guidance information for assessment	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and</p>

	literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems</li> </ul>
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	<p>and practices</p> <ul style="list-style-type: none"> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Cost components</b>	<p>Cost components include:</p> <ul style="list-style-type: none"> <li>• fixed and variable costs, such as power/energy, materials, plant and equipment, production or process time, including impact on salary and wages</li> <li>• office expenses, such as telephone</li> <li>• government taxes and charges</li> </ul>
<b>Process</b>	<p>Process may include:</p> <ul style="list-style-type: none"> <li>• a production, maintenance, logistics, office or other support process in an organisation</li> </ul>
<b>Overall cost</b>	<p>Overall cost may include:</p> <ul style="list-style-type: none"> <li>• the assessment of negative and positive financial implications</li> <li>• negative long-term issues, such as occupational health and safety (OHS), environmental and regulatory issues</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS402051A Apply quality standards

### Modification History

New unit, superseding MSACMT251A Apply quality standards - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to apply quality standards to work operations in an organisation. The unit is designed to complement competitive systems and practices units.

### Application of the Unit

This unit applies to an individual who is expected to take responsibility for the quality of their own work, and to take actions specified in the procedures and within the scope of their job and authority to ensure that quality standards are met.

This unit requires the application of skills associated with interpreting and applying workplace standards and identifying and addressing problems that interfere with quality outcomes. The unit requires initiative, enterprise and self-management to ensure quality standards are achieved.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.



## Elements and Performance Criteria

- |   |   |     |  |
|---|---|-----|--|
| 1 | Assess own work   | 1.1 | Continuously check completed work against workplace standards relevant to the operation being undertaken   |
|   |   | 1.2 | Demonstrate an understanding of how the work activities and completed work relate to the next production process or processes and to the final products or services concerned                                  |
|   |   | 1.3 | Identify and isolate faulty components, products or processes  |
|   |   | 1.4 | Record and/or report faults and any identified causes to the supervisor concerned, where required, in accordance with workplace procedures   |
| 2 | Assess quality of received components, parts or materials | 2.1 | Continuously check received components, parts, materials, information, service or final products against workplace standards and specifications for conformance  |
|   |   | 2.2 | Demonstrate an understanding of how the received components, parts or materials, information or service relate to the current operation and how they contribute to the final quality of the product or service |
|   |   | 2.3 | Identify and isolate faulty components, parts, materials or information that relate to the operator's work   |
|   |   | 2.4 | Record and/or report faults and any identified causes in accordance with workplace procedures  |
|   |   | 2.5 | Identify causes of any identified faults and take corrective action as specified in workplace procedures   |
| 3 | Measure components, parts or materials                    | 3.1 | Measure materials, component parts, information, service or products, as required, using the appropriate measuring instruments in accordance with workplace procedures   |

4	Record information on production indicator	4.1	Record basic information on quality and other indicators of process performance in accordance with workplace procedures
5	Investigate causes of quality deviations	5.1	Investigate and report causes of deviations from specified quality standards for components
		5.2	Recommend suitable preventative action based on workplace quality standards and the identified causes of deviations from specified quality standards of materials

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- interpreting work instructions, specifications, standards and patterns appropriate to own work
- carrying out relevant visual inspections of materials, component parts and final products
- carrying out relevant physical/chemical measurements or tests
- maintaining accurate work records in accordance with procedures
- carrying out work in accordance with occupational health and safety (OHS) policies and procedures
- meeting work specifications
- communicating effectively within defined workplace procedures
- interpreting and applying defined procedures

### Required knowledge

Required knowledge includes:

- relevant quality standards, policies and procedures
- relevant production processes, materials and products
- basic characteristics of materials used in the relevant production processes
- safety and environmental aspects of relevant production processes
- relevant measurement techniques and quality checking procedures
- workplace procedures
- reporting procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• interpret, relevant work instructions, standards and specifications appropriate to own work</li> <li>• check and measure relevant quality parameters</li> <li>• interpret results of quality checks in terms of specifications, patterns and work standards</li> <li>• take required action where standards of materials, component parts, final product or work processes are found to be unacceptable</li> <li>• maintain accurate records.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of</li> </ul>

	<p>contingencies, improvement scenarios, and so on)</p> <ul style="list-style-type: none"> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> </ul>
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	<ul style="list-style-type: none"> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Quality parameters</b>	<p>Quality parameters may include:</p> <ul style="list-style-type: none"> <li>• finish</li> <li>• size</li> <li>• durability</li> <li>• product or process variations</li> <li>• materials</li> <li>• alignment</li> <li>• colour</li> <li>• damage and imperfections</li> <li>• time</li> </ul>
<b>Quality checks</b>	<p>Quality checks are against set parameters for the process or product. Examples include:</p> <ul style="list-style-type: none"> <li>• visual inspection</li> <li>• physical measurements</li> <li>• chemical tests</li> <li>• checks against patterns, templates and guides</li> <li>• processing time</li> </ul>
<b>Materials</b>	<p>Materials may include:</p> <ul style="list-style-type: none"> <li>• physical raw materials</li> <li>• orders, forms and other documentation</li> <li>• services required for undertaking an operation (e.g. power, water, compressed air and fuel)</li> </ul>

<b>Measure</b>	<p>Measure includes:</p> <ul style="list-style-type: none"> <li>those measurements which may be taken by the employee in the workplace/at their work station</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> <li>formulas/recipes</li> <li>batch sheets</li> <li>temporary instructions and similar instructions provided for the operation of the plant</li> <li>good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>written, verbal, computer-based or in some other format</li> </ul>
<b>Indicators of production performance</b>	<p>Indicators of production performance may include:</p> <ul style="list-style-type: none"> <li>number of items/production rate</li> <li>delays and causes of delays (where known)</li> <li>other information as specified in the procedures</li> </ul>
<b>Data entry/recording</b>	<p>Data entry/recording may include:</p> <ul style="list-style-type: none"> <li>keyboard</li> <li>written (including ticks or signs)</li> <li>verbal</li> </ul>
<b>Sources of information/ documents</b>	<p>Sources of information/documents may include:</p> <ul style="list-style-type: none"> <li>quality and Australian standards and procedures</li> <li>work instructions, patterns, designs and recipes</li> <li>organisation work procedures</li> <li>manufacturer instructions for materials and equipment</li> <li>organisational or external personnel</li> <li>customer requirements</li> </ul>
<b>Investigate and report</b>	<p>Investigate and report includes:</p> <ul style="list-style-type: none"> <li>following set procedures defined for such investigations</li> </ul> <p>Set procedures may include:</p> <ul style="list-style-type: none"> <li>verbal instructions</li> </ul>

	<ul style="list-style-type: none"> <li>documented procedures</li> <li>other quality procedures as implemented within an organisation or work environment</li> </ul>
<b>Workplace context</b>	<p>Workplace context includes:</p> <ul style="list-style-type: none"> <li>work organisation procedures and practices relating to the manufacture and quality outcomes for products</li> <li>conditions of service, legislation and industrial agreements, including: <ul style="list-style-type: none"> <li>workplace agreements and awards</li> <li>federal or state/territory legislation</li> <li>standard work practice</li> </ul> </li> </ul>
<b>Reporting/communication</b>	<p>Reporting/communication may include:</p> <ul style="list-style-type: none"> <li>verbal and written communication in accordance with organisational policies and procedures</li> <li>oral, written or visual communication and may include simple data</li> </ul>
<b>Being responsible for the maintenance of own work quality</b>	<p>Being responsible for the maintenance of own work quality may include:</p> <ul style="list-style-type: none"> <li>contributing to the quality improvement of team or section output, where necessary, in accordance with workplace procedures</li> <li>following safety, environmental, housekeeping and quality procedures as specified by materials/machine/equipment manufacturers, regulatory authorities and the organisation</li> </ul>
<b>Applicable regulations and legislation</b>	<p>Applicable regulations and legislation may include:</p> <ul style="list-style-type: none"> <li>OHS legislation relevant to workplace activities</li> <li>workers compensation legislation</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.





## **MSS402060A Use planning software systems in operations**

### **Modification History**

New unit, superseding MSACMT260A Use planning software systems in manufacturing -  
Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to access planning software (often known as Enterprise resource Planning (ERP), Materials Resource Planning (MRP and MRPII), and often by a proprietary name, to make routine business decisions required of the person as a regular part of their job.

### **Application of the Unit**

This unit applies to an individual in an organisation using a planning software system and who must interface with that system. The unit applies to both accessing information from the planning software system and using it as an aid to decision making. This unit requires the application of communication, planning, and problem solving associated with using planning software in own work.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Use interface	1.1	Identify terminals relevant to own work station and functions
		1.2	Use keyboards, track ball/mouse and monitor and/or other peripherals to access system
		1.3	Navigate through system and screens to find program menu and data relevant to own work
		1.4	Identify and input information on own work processes at required frequency and to required detail
		1.5	Access message section and acknowledge messages
		1.6	Identify problems and make suggestions for improvements to relevance of planning software to own work
2	Access information	2.1	Identify work processes that require information from planning software system
		2.2	Obtain relevant data and information on current operations from the planning software system
		2.3	Identify the status of items in the value stream
		2.4	Access historical data and information
		2.5	Interpret information and identify and prioritise any actions required in response to information
3	Take appropriate actions in accordance with procedures	3.1	Take actions in response to information obtained from planning software
		3.2	Follow up as appropriate to ensure anticipated results have occurred
		3.3	Record adjustments and variations according to procedures

### 3.4 Identify any learning needs to use planning software and seek appropriate support

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading and interpreting electronic and hard copy operating instructions and documents, including where used:
  - work instructions
  - standard operating procedures
  - formulas/recipes
  - production and batch sheets
  - temporary instructions
  - other provided operating instructions
- working within access control requirements of the planning software system
- identifying modules, screens, files, and so on, of software relevant to own work
- logging in and using terminals and planning software at a level of access appropriate to own work
- accurately inputting data
- searching and retrieving data
- accessing nominated assistance with planning software

### Required knowledge

Required knowledge includes:

- technical knowledge needed to operate own work processes
- planning software system and operation, including:
  - terminal locations and types
  - security and access arrangements
  - range of information held in planning software relevant to own work
  - data collection methods for operations in work area
  - assistance arrangements for users of planning software
  - business activities exercised by/through the planning software system
- value created by operations for customers

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify the scope and relevance of planning software system to their own work</li> <li>• enter and retrieve data, including normal performance and variations</li> <li>• use planning software system to assist in own work</li> <li>• contribute suggestions for improvement to performance and relevance of planning software to own work area.</li> </ul>
Context of and specific resources for assessment	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
Method of assessment	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues</li> </ul>

	<p>(third-party reports)</p> <ul style="list-style-type: none"> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> </ul>
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	<ul style="list-style-type: none"> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Planning software</b>	<p>Planning software includes:</p> <ul style="list-style-type: none"> <li>• software systems which integrate a range of business information, such as finance, logistics maintenance and production (frequently referred to as ERP, MRP, MRPII or a range of proprietary names)</li> </ul>
<b>Relevant data and information</b>	<p>Relevant data and information may include:</p> <ul style="list-style-type: none"> <li>• technical and other drawings</li> <li>• standard operating procedures and other work instructions</li> <li>• production schedules including historical data</li> <li>• orders and order tracking information</li> <li>• stock control</li> <li>• contact lists</li> <li>• occupational health and safety (OHS) information</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement, stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> </ul>

	<ul style="list-style-type: none"> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>
<b>Items in the value stream</b>	<p>Items in the value stream refer to information held within the planning software system that contributes to creating value as determined by the customer. Depending on the organisation it may include:</p> <ul style="list-style-type: none"> <li>• physical elements of the production system, such as sites, work stations, equipment, material, including stock, work in progress and finished products</li> <li>• information needed to meet customer requirements, such as designs, drawings, work instructions, standard operating procedures, standards, material lists and pricing</li> <li>• information not directly related to current customer requirements but required by the organisation</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.



## MSS402061A Use SCADA systems in operations

### Modification History

New unit, superseding MSACMT261A Use SCADA systems in manufacturing - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required by an individual to interact with a System Control and Data Acquisition (SCADA) system as part of their job.

### Application of the Unit

This unit applies to an individual in an organisation using a SCADA system and the individual must interface with that system. The individual will need to access this system as part of their routine and take actions based on the information they obtain from the SCADA system in accordance with procedures.

This unit requires the application of skills associated with using communication tools and technology for management of own work, planning and problem solving.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |     |   |
|---|---|-----|---|
| 1 | Use operator interface                              | 1.1 | Identify SCADA terminals relevant to own work station and functions   |
|   |   | 1.2 | Use keyboards, track ball, monitor and/or stand alone controllers to access/interrogate system                    |
|   |   | 1.3 | Use correct level of access and find all relevant screens and information   |
|   |   | 1.4 | Access message section and acknowledge messages   |
|   |   | 1.5 | Input and output information correctly according to program and organisation requirements                         |
| 2 | Use information                                     | 2.1 | Obtain data and information from SCADA, as required, including process, supply and product chain data             |
|   |   | 2.2 | Interpret data and information as required by own job   |
|   |   | 2.3 | Find and use relevant historical data and information   |
|   |   | 2.4 | Use manufacturer manuals or specifications, as required, to expand knowledge of SCADA system relevant to own work |
|   |   | 2.5 | Determine and prioritise required actions   |
| 3 | Make required changes in accordance with procedures | 3.1 | Adjust production/process in response to SCADA information  |
|   |   | 3.2 | Record adjustments and variations to specifications/schedules and report to appropriate personnel                 |
|   |   | 3.3 | Seek feedback and information on adjustments to further improve procedures, where required                        |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using SCADA terminals and other input devices
- reading and interpreting electronic and hard copy SCADA operating instructions and documents, including where used:
  - work instructions
  - standard operating procedures
  - temporary instructions
  - other provided operating instructions
- working within security and access control requirements of the SCADA system
- identifying modules, screens, and so on, of SCADA system relevant to own work
- accurately inputting and outputting data
- searching and retrieving data
- accessing SCADA system nominated assistance, when required

### Required knowledge

Required knowledge includes:

- technical knowledge needed to operate own work processes
- hierarchy of SCADA system and operation
- information available from and controls exercised by/through the SCADA system

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• identify the scope and relevance of the SCADA system to their own work</li><li>• access correct levels of the SCADA system</li><li>• enter and retrieve data, including normal performance and variations</li></ul>
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	<ul style="list-style-type: none"> <li>• use SCADA system to assist in own work.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented ,or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as SCADA software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>SCADA</b>	<p>SCADA refers to:</p> <ul style="list-style-type: none"> <li>• a number of systems which automatically collect</li> </ul>

	<p>critical process data, perform required mathematical manipulations on it and then make control decisions and/or give required information to personnel for action</p> <p>In some industry sectors, the SCADA system is sometimes integrated into other sophisticated computer control systems, such as Distributed Control System (DCS). These sectors may simply refer to their SCADA as the DCS or other similar term (such as the proprietary name of the computer system).</p> <p>SCADA systems may provide information from outside of the process, such as stock/material levels in a customer plant and/or available supply, supply rates and pricing from a supplier plant. This information may all be accessed by the SCADA system and the employee using it in order to make production rate and other control decisions (either automatically or human assisted) about their own operations and work processes</p>
<b>Supply and product chains</b>	<p>The supply chain Includes:</p> <ul style="list-style-type: none"> <li>all suppliers in the chain from the initial raw material up to the current step in the operations process</li> </ul> <p>The product chain includes:</p> <ul style="list-style-type: none"> <li>all steps after the current step up to the final customer</li> </ul> <p>Competitive systems and practices organisations encompass the entire production system, beginning with the customer, and includes:</p> <ul style="list-style-type: none"> <li>the product sale</li> <li>outlet</li> <li>the final assembler</li> <li>product design</li> <li>raw material mining and processing</li> <li>all tiers of the value stream (sometimes called the supply chain)</li> </ul> <p>Any truly 'competitive' system is highly dependent on the demands of its customers and the reliability of its suppliers. No implementation of competitive systems and practices can reach its full potential without including the entire 'organisation' in its planning</p>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> </ul>

	<ul style="list-style-type: none"><li>• formulas/recipes</li><li>• batch sheets</li><li>• temporary instructions and similar instructions provided for the smooth running of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li><li>• government regulations</li></ul> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer-based or in some other format</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS402080A Undertake root cause analysis**

### **Modification History**

New unit, superseding MSACMT280A Undertake root cause analysis - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to undertake root cause analysis (RCA) by any person. This will often be undertaken by people working in a team. This unit also covers the competencies needed by operators to contribute to an advanced maintenance strategy using RCA coupled with diagrams and charts.

### **Application of the Unit**

This unit applies to individuals working in an organisation which is applying competitive systems and practices strategies. The unit applies to the formal problem solving to root cause that the individual must undertake in their own work area or where the individual contributes to problem solving to root cause as part of a team.

This unit requires an ability to seek and apply information from a variety of sources in order to inform RCAs. Initiative and enterprise is also required to identify quick fix and permanent solutions to problems.

Where training in a wider range of problem solving techniques and tools is required the unit MSAPMSUP390A Use structured problem solving tools should be selected.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to



essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Recognise problems	1.1	Identify features or occurrences indicative of a problem
		1.2	Use appropriate tools, techniques and charts to define the problem
2	Implement quick fix	2.1	Recommend a quick fix within the scope of competency and authority
		2.2	Use technology or processes relevant to the problem to implement quick fix
3	Determine root cause	3.1	Identify a range of possible causes
		3.2	Gather data and other information to eliminate or confirm possible causes
		3.3	Use available data and information to link causes and effects
		3.4	Seek assistance, as required
		3.5	Identify root cause
4	Develop permanent solution	4.1	Identify a range of methods to eliminate the root cause or break the cause tree
		4.2	Select the most appropriate solution
		4.3	Liaise with relevant people
		4.4	Recommend or implement solution within the limits of competency and authority

#### 4.5 Monitor impact of solution and make further recommendations, as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- cooperating and working with others on problem solving
- assessing and recording information from a variety of sources
- defining potential problems factually, including:
  - location and extent of problem or incident
  - sequence of events where relevant
  - extent of deviation from normal operation or performance
- analysing potential problems across a range of varied activities and knowledge applications
- reading and constructing simple charts, such as cause and effect diagrams

### Required knowledge

Required knowledge includes:

- RCA methodology, including difference between quick fixes and root cause elimination or breaking of causal tree
- principles and normal operation of equipment, plant and processes in own work area sufficient to undertake a RCA and propose solutions
- common variances to normal performance that are indicators of a problem
- use of relevant analysis tools (e.g. cause/effect diagrams, Pareto charts and 5 Whys)
- operations in own work area

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and</b>	A person who demonstrates competency in this unit must
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<b>evidence required to demonstrate competency in this unit</b>	<p>be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• undertake problem identification</li> <li>• use appropriate processes to achieve root cause identification</li> <li>• prioritise solutions</li> <li>• recommend solutions and implementation procedures to problems within own area and range of technical skills and knowledge</li> <li>• evaluate implementation of solutions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess response to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and</p>

	disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul>
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	<p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Features or occurrences indicative of a problem</b>	<p>Examples of features or occurrences indicating problems include:</p> <ul style="list-style-type: none"> <li>variation to normal plant or equipment operation</li> <li>unplanned or non-conforming process or operations outcomes</li> <li>out of specification products</li> <li>excess scrap</li> <li>accidents and emergencies</li> <li>regulatory breaches</li> <li>customer returns and complaints</li> <li>reduction or loss of sales</li> </ul>
<b>Root cause</b>	<p>There are many possible causes of any problem. The root cause contrasts with other possible causes of a problem which when eliminated have no impact or only ameliorate the problem. Elimination of the root cause permanently eliminates the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found.</p>
<b>Cause tree</b>	<p>The series of causes is referred to as the cause tree. Not all root causes are accessible and able to be eliminated. Breaking the cause tree is such a way that the problem cannot recur is an acceptable alternative.</p> <p>Not all situations can wait for the RCA and eventual elimination of the root cause as there may be serious current impacts. The quick fix will control these immediate impacts, but does not eliminate the root cause.</p>
<b>Quick fix</b>	<p>A quick fix is not a short cut or side step for a permanent solution to the root cause. It is a necessary step designed to control the immediate impacts of a problem, for example, to prevent ongoing errors or to ameliorate damage.</p>
<b>Appropriate techniques/charts</b>	<p>Appropriate techniques/charts may include:</p> <ul style="list-style-type: none"> <li>control charts</li> <li>Pareto charts</li> </ul>

	<ul style="list-style-type: none"><li>• run charts</li><li>• flow charts</li><li>• cause and effect diagrams</li><li>• tree diagrams</li><li>• 5 Whys analysis</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403001A Implement competitive systems and practices**

### **Modification History**

New unit, superseding MSACMS400A Implement a competitive manufacturing system - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to implement and review competitive systems and practices in a person's own work within a team or work area, including the consideration of the impact on the work of others. The unit focuses on the holistic application of competitive systems and practices to achieve improved performance in own work and in activities with others in the team or work area that contribute to improving customer benefit.

### **Application of the Unit**

This unit applies to individuals who are applying competitive systems and practices to their own work in a way that integrates with others in the team or work area who are also implementing competitive systems and practices. Depending on the operations or processes in the team or work area the unit may also include interaction with other teams and work areas.

The unit is suitable for individuals who have formal responsibility for the work of others, such as team leaders. It is also suitable for individuals, such as technicians and tradespeople, who must integrate the application of their technical skills with the implementation of competitive systems and practices in an organisation.

The unit applies to the areas of cost, quality, delivery, safety/environment, and employee capability including continuous reviewing of performance against these five areas in liaison with other relevant people. Improvement initiatives in these five areas are usually developed and implemented with the support of technical support staff. Whereas other units may emphasise the competence to use one or more competitive practices, this unit emphasises the ability to advance on all five key areas over a moderate time period.

This unit requires the application of skills associated with problem solving and initiative and enterprise in order to identify opportunities to make improvements and maximise performance. Communication, the ability to work in a team and planning and organising skills are required to implement improvements and address any conflicts that arise. This unit also requires an ability to identify appropriate technology, and to consider and integrate feedback on how personal performance can be improved.

### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Contribute to the improvement of the operations system in team or work area	1.1	Identify key performance indicators for area of operations
		1.2	Implement and review competitive systems and practices to improve health, safety and environment (HSE) performance of self and others
		1.3	Implement and review competitive systems and practices to maximise quality consistency
		1.4	Implement and review competitive systems and practices and identify any skill and training issues that need to be addressed to improve capability of self and others
		1.5	Implement and review competitive systems and practices to maximise customer benefit/cost ratio
		1.6	Implement and review competitive systems and practices to reduce lead time to delivery within the scope of authority and responsibility
		1.7	Work with relevant stakeholders to resolve conflicts



			which arise from implementation of competitive systems and practices
		1.8	Select improvements which will deliver the greatest overall benefit for the resources required/available without reducing current performance on individual factors
2	Implement improvements	2.1	Implement the chosen improvement/s
		2.2	Check the selected improvements improve the system as a whole and do not result in unintended consequences
		2.3	Monitor implementation and make adjustments, as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others to clarify scope of implementation of competitive systems and practices, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators/metrics
  - identification and elimination of waste (muda)
- monitoring performance in key areas, including:
  - HSE performance
  - quality consistency
  - capability and performance by team members
  - customer benefit/cost ratio
  - reduce lead time to delivery

- contributing suggestions for improvement
- analysing operational procedures in terms of flow and contribution to customer outcomes
- planning tasks to support competitive systems and practices implementation
- identifying and implementing appropriate data gathering and analysis techniques within area of responsibility to identify change over time in indicators relating to:
  - cost
  - quality
  - delivery
  - safety/environment
  - employee capability and support for competitive systems and practices
- solving problems to root causes

## Required knowledge

Required knowledge includes:

- customers and the value they derive from products and processes of the organisation or area
- cost components and their relationship to customer benefits/features
- suppliers and their capabilities
- waste (muda)
- factors causing variability in a product and how to control them
- factors that promote standardisation
- relevant competitive systems and practices tools for area and how to apply them
- factors impacting on the product, process and waste, particularly those wholly or partially under own and other immediate area employees control (and how to control them)
- good HSE practice and factors impacting on HSE performance
- own capability and how to improve it
- optimisation techniques appropriate to the organisation and the job
- application of quality standards and processes

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• identify key performance indicators appropriate to their own work area</li></ul>
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	<ul style="list-style-type: none"> <li>• implement and review competitive systems and practices in own work, including interaction with others in the work area in the areas of:             <ul style="list-style-type: none"> <li>• HSE performance</li> <li>• quality consistency</li> <li>• capability and performance by team members</li> <li>• customer benefit/cost ratio</li> <li>• reduce lead time to delivery</li> </ul> </li> <li>• select improvements that deliver the greatest overall benefit</li> <li>• monitor the implementation of improvements and make appropriate adjustments.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning for appropriate portions</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess</p>

	<p>underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> </ul>
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	<ul style="list-style-type: none"> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Competitive systems and practices tools</b>	<p>Competitive systems and practices tools include:</p> <ul style="list-style-type: none"> <li>• 5S</li> <li>• 6 sigma</li> <li>• continuous improvement</li> <li>• cause effect diagrams</li> </ul>
<b>Customer</b>	<p>Competitive systems and practices organisations encompass the entire production system, beginning with the customer, and includes:</p> <ul style="list-style-type: none"> <li>• the product sales outlet</li> <li>• the final assembler</li> <li>• product design</li> <li>• raw material mining and processing</li> <li>• all tiers of the value stream (sometimes called the supply chain)</li> </ul> <p>Customer may include:</p> <ul style="list-style-type: none"> <li>• internal or external customers, and should also include the final customer as the basis for the identification of waste</li> </ul> <p>The unit does not require interfacing directly with the external customer, but there should be sufficient information to identify customer benefits and features</p>
<b>Supplier</b>	<p>Supplier may include:</p> <ul style="list-style-type: none"> <li>• an internal supplier</li> <li>• an external supplier</li> </ul> <p>The unit does not require interfacing directly with external suppliers, but there should be sufficient information to enable identification of supplier abilities</p>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production</p>

	<p>System and its derivatives) is any activity which does not contribute to customer benefit/features in the product. Categories of waste include:</p> <ul style="list-style-type: none"> <li>• excess production and early production</li> <li>• delays</li> <li>• movement and transport</li> <li>• poor process design</li> <li>• inventory</li> <li>• inefficient performance of a process</li> <li>• making defective items</li> <li>• other activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>
<b>Operations</b>	<p>Operations indicate:</p> <ul style="list-style-type: none"> <li>• the holistic combination of the process, plant and equipment, procedures and practices, including the skills and work organisation of the workforce, which make up the productive organisation</li> </ul>
<b>Implement improvements</b>	<p>Implementation of improvements may be undertaken:</p> <ul style="list-style-type: none"> <li>• within own job role</li> <li>• as part of processes and operations in the work area or team</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403002A Ensure process improvements are sustained**

### **Modification History**

New unit, superseding MSACMS401A Ensure process improvements are sustained - Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to ensure that the gains which have been made by using improved methods, processes and equipment are sustained as the new baseline/standard for an area of work and so prevent regression to former practices, or digression to less efficient practices.

### **Application of the Unit**

This unit applies to individuals working in a team or work area who have already implemented competitive systems and practices related improvements in their own work and who must work effectively with others implementing competitive systems and practices to ensure that performance improvement gains are sustained.

The unit is also suitable for individuals who have formal or informal responsibility for the work of others, such as team leaders; individuals, such as senior operators, who must mentor others; or individuals, such as technicians and tradespeople, who must integrate the application of their technical skills with the implementation of competitive systems and practices in an organisation.

The unit can be applied to all areas of an organisation, including production, maintenance, logistics and office functions.

The unit covers the implementation of practices to ensure that process improvements are sustained and opportunities taken to suggest further improvements. If mistake proofing is used as one of the methods for ensuring that process improvements are sustained, the unit MSS403051A Mistake proof a production process should be selected.

Improvement initiatives can be made by any of any number of methods and by teams or individuals. The unit assumes that desired levels of performance or quality are known.

This unit requires the application of skills associated with problem solving, initiative and enterprise, and planning and organising in order to check and monitor the impacts of change. It also requires communication and the ability to work with others to assess the impact of change in own work and on other's work, as well as self-management and learning to adapt improvements according to new information and feedback.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Examine previous improvements	1.1	Identify impact of previous process improvements to systems, equipment, operations or products in work area
		1.2	Identify improvements that have not met objectives
2	Ensure corrective actions are implemented	2.1	Identify corrective actions that can be taken on process improvements that have not met objectives
		2.2	Liaise with relevant people associated with the anticipated corrective action
		2.3	Obtain any required approvals
		2.4	Ensure the supply of resources
		2.5	Check impacts of corrective action on occupational health and safety (OHS), quality and environmental systems in work area and take action in accordance with procedures, if required



		2.6	Check that self and others in team or work area have required skills for corrective actions
		2.7	Monitor implementation of corrective action
		2.8	Make required adjustments
3	Verify systems support improvement	3.1	Ensure procedures reflect improvements
		3.2	Check that training and assessment activities in team or work area reflect improvements
		3.3	Liaise with relevant people to ensure their support of the new or modified system/s
4	Audit the change	4.1	Determine an appropriate audit period/cycle
		4.2	Agree relevant measures/indicators for the improvement
		4.3	Measure performance at agreed times using agreed measures
		4.4	Investigate causes of under-performance
		4.5	Take appropriate corrective action to improve performance
		4.6	Re-audit the improvement on an agreed basis

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others to clarify scope and stage of implementation of competitive systems and practices and contribute suggestions for further improvements in implementation
- examining normal operational procedures in terms of flow and contribution to customer benefit
- planning own tasks, including the impact on others to support competitive systems and

practices implementation

- implementing competitive systems and practices in own work area according to instructions
- identifying waste (muda)
- monitoring competitive systems and practices performance indicators for own work and work area

## Required knowledge

Required knowledge includes:

- overall procedures for and process of operations relative to improvements being made
- appropriate measures of performance
- business performance goals sufficient to determine best measures of improved performance

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify process and operational changes as a result of implementation of competitive systems and practices</li> <li>• identify and assess impact of performance improvements in a work area against objectives</li> <li>• identify actions and resources required for further improvements</li> <li>• communicate and negotiate with others on improvements</li> <li>• apply procedures for seeking approvals and reporting non-conformances</li> <li>• determine appropriate period and procedures for monitoring implemented changes.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned,</li> </ul>

	<p>currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using some combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Improvement</b>	<p>Improvement may be any change aimed at reducing waste (muda). This unit is not about making the improvements, but ensuring beneficial changes remain in place</p>
<b>Customers</b>	<p>Customers may include:</p> <ul style="list-style-type: none"> <li>• internal or external customers, including final</li> </ul>

	<p>customers, as these should be used as the basis for the identification of value and waste</p> <p>The individual does not need to interface directly with the external customer, but should be able to sufficiently identify customer benefit and customer features in processes and operations of their team and their work area</p>
<b>Suppliers</b>	<p>Suppliers may be:</p> <ul style="list-style-type: none"> <li>internal or external suppliers and should be sufficiently close to the individual's work as to be easily identifiable</li> </ul> <p>The operator does not need to interface directly with external suppliers, but should be provided with sufficient information to enable them to identify supplier contribution to their own work and to customer benefit</p>
<b>Systems</b>	<p>Systems are used to mean any/all of the equipment, processes, procedures and work practices that are used to produce the product. A term often used in this context includes:</p> <ul style="list-style-type: none"> <li>kaizen - the philosophy of continual improvement that every process can and should be continually evaluated and improved in terms of time required, resources used, resultant quality and other aspects relevant to the process</li> </ul>
<b>Resources</b>	<p>Resources for corrective actions may include:</p> <ul style="list-style-type: none"> <li>equipment</li> <li>modifications</li> <li>consumables</li> <li>people</li> <li>suitable work area</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> <li>formulas/recipes</li> <li>batch sheets</li> <li>temporary instructions and similar instructions provided for the smooth running of the organisation</li> <li>good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care) and government regulations</li> </ul>

	<p>Procedures may be:</p> <ul style="list-style-type: none"><li>written, verbal, computer-based or in some other format</li></ul>
<b>Improvements</b>	<p>Improvements include:</p> <ul style="list-style-type: none"><li>techniques for preventing mistakes by designing the operations process, equipment and tools so that an operation literally cannot be performed incorrectly (e.g. baka-yoke)</li><li>techniques that generate warning signals were a mistake is about to be performed (poka-yoke)</li></ul> <p>Improvements may be sustained by:</p> <ul style="list-style-type: none"><li>use of technology so that it is impossible to do the job any other way</li><li>changes to process or procedures or other changes to the operations system which, if followed, will sustain the change and this unit may be applied to all these situations</li></ul>
<b>Measuring performance</b>	<p>Measuring improvements may include:</p> <ul style="list-style-type: none"><li>personally taking measurements</li><li>arranging for measurements to be taken/made by appropriate personnel</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403010A Facilitate change in an organisation implementing competitive systems and practices**

### **Modification History**

New unit superseding MSACMC410A Lead change in a manufacturing environment - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required by individuals responsible for facilitating change processes in an organisation implementing competitive operational practices.

### **Application of the Unit**

This unit applies to people who facilitate the change process resulting from implementing one or more competitive systems or practices. This implementation may also be associated with other changes, such as the introduction of new products, processes or equipment. The unit will usually apply to people whose responsibility is at the team, area or section level rather than the whole organisation. The responsibility may be formally designated or be informal, as in mentoring and assisting fellow employees.

This unit assumes that consultation and agreement on the implementation of the competitive systems and practices and other associated changes has already occurred and the nature and extent of the change has been agreed.

This unit does not cover the negotiation of change in a formal industrial relations sense but does cover the skills needed to identify real or potential change implementation issues, including those that may need to be referred to formal consultation and/or dispute settlement procedures.

This unit has a strong emphasis on planning, encouraging and facilitating in a changing environment within the organisation, including using appropriate communication, teamwork, problem solving, initiative and self-management.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Define nature and impact of change for designated area and processes | 1.1 | Identify the organisation's aims and objectives for the competitive systems and practices techniques related to the change process |
|   |  | 1.2 | Identify opportunities for implementation of change within work area   |
|   |  | 1.3 | Determine impacts of change for work area, including potential benefits and impacts on own work and work of fellow employees       |
| 2 | Identify key performance indicators (KPIs)                           | 2.1 | Liaise, where required, with managers, engineers and other staff responsible for designing and/or implementing change              |
|   |  | 2.2 | Identify KPIs for own work responsibility and that of the work area  |
|   |  | 2.3 | Communicate KPIs to fellow employees   |
|   |  | 2.4 | Check that data collection and processing are appropriate for KPIs   |
|   |  | 2.5 | Raise and resolve issues related to KPIs with relevant personnel   |



- |   |   |     |   |
|---|---|-----|---|
| 3 | Liaise with key stakeholders                | 3.1 | Identify key stakeholders impacted by the change  |
|   |   | 3.2 | Communicate with key stakeholders within scope of authority   |
|   |   | 3.3 | Identify and address issues and concerns of each stakeholder if within scope of authority   |
|   |   | 3.4 | Develop and/or locate information required to address key concerns  |
|   |   | 3.5 | Refer issues and concerns outside of scope of authority to appropriate personnel  |
| 4 | Develop a strategy to help implement change | 4.1 | Identify or develop a work plan for implementing change   |
|   |   | 4.2 | Make information required to support change available to team members   |
|   |   | 4.3 | Communicate/circulate draft work plan to other employees in work area, supervisors, technical experts and other appropriate personnel for comment |
|   |   | 4.4 | Assess suggested changes and incorporate into work plan, where appropriate  |
| 5 | Implement change                            | 5.1 | Obtain authorisation to commence change implementation in accordance with organisation procedures   |
|   |   | 5.2 | Implement change in accordance with work plan and organisational occupational health and safety (OHS) and consultation procedures                 |
| 6 | Monitor implementation of change            | 6.1 | Maintain open communication channels with all stakeholders during implementation  |
|   |   | 6.2 | Monitor KPIs during implementation  |
|   |   | 6.3 | Encourage and facilitate improvement suggestions of team members  |
|   |   | 6.4 | Identify areas requiring improvement in change  |

## implementation

### 6.5 Make improvements to implementation according to organisation procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying the competitive operational practices being implemented in the organisation, including:
  - Just in Time (JIT) and kanban systems
  - preventative maintenance
  - 5S housekeeping
  - continuous improvement processes (e.g. kaizen)
  - waste (muda) elimination
  - formal problem solving procedures (e.g. root cause analysis (RCA))
- identifying other products, processes or equipment changes being implemented within area of responsibility
- identifying the work and culture changes required for effective implementation of the competitive systems and practices being implemented and other products, processes or equipment changes
- identifying organisation KPIs and contextualise for area of responsibility to determine successful change implementation
- planning strategies for change implementation, including:
  - required communication with others
  - negotiations if any required with internal and external suppliers, customers and delegates
  - analysis of any skill gaps in self and others
  - required training
  - data collection
  - work organisation and procedure changes
  - risk identification and contingency measures
- monitoring performance against KPIs and taking appropriate corrective action in the event of a non-conformance
- identifying and communicating with sources of assistance if difficulty is experienced with changes

## Required knowledge

Required knowledge includes:

- features of common competitive operational practices, including:
  - JIT and kanban systems
  - preventative maintenance
  - 5S housekeeping
  - continuous improvement processes (e.g. kaizen)
  - waste (muda) elimination
  - formal problem solving procedures (e.g. RCA)
- health, safety and environment (HSE) principles and requirements for area of responsibility
- change implementation contacts and procedures relevant to work area
- employee assistance mechanisms in the organisation
- processes to develop work plans, including consideration of timetable, KPIs, training needs, OHS implications, contingency plans and responsibilities (the work plan must be capable of being coherently communicated to others)

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• identify the competitive systems and practices used in their own work</li><li>• identify changes to their own work flowing from the implementation of the relevant competitive systems and practices</li><li>• implement changes</li><li>• know when and how to seek assistance with work changes</li><li>• make suggestions for improvements.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned,</li></ul>

	<p>currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using some combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Team</b>	<p>Team may include:</p> <ul style="list-style-type: none"> <li>• work teams from all sections of an organisation, including production or other operational areas, maintenance, technical, administration/finance, and sales/marketing</li> </ul>
<b>Change</b>	<p>The philosophy of continual improvement is that every</p>

	<p>process can and should be continually evaluated and improved in terms of time required, resources used, resultant quality, and other aspects relevant to the process.</p> <p>Superimposed on this is the concept of breakthrough change when a large change/improvement is made which can shift the direction or operation of the organisation. Once such breakthrough change is the introduction of competitive operational practices.</p>
<b>Work plan for change</b>	<p>The work plan for change covers the designated work area and may include, depending on the organisation and work area processes:</p> <ul style="list-style-type: none"> <li>• timetable</li> <li>• KPIs</li> <li>• training needs</li> <li>• OHS implications</li> <li>• contingency plans</li> <li>• responsibilities with team members and senior managers, engineers and other staff responsible for designing and/or implementing change</li> </ul>
<b>Issues and concerns</b>	<p>Issues and concerns may be communicated formally and informally and may include:</p> <ul style="list-style-type: none"> <li>• individual and group concerns</li> <li>• those expressed by and through industrial processes</li> </ul>
<b>Gathering and monitoring performance data</b>	<p>Performance data may be gathered and monitored:</p> <ul style="list-style-type: none"> <li>• manually by individual employees through charts, tally sheets or keypad/board entry</li> <li>• automatically through software, such as SCADA software, ERP systems, MRP and proprietary systems</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS403021A Facilitate a Just in Time system

### Modification History

New unit, superseding MSACMT421A Facilitate a Just in Time (JIT) system - Equivalent

### Unit Descriptor

This unit of competency covers skills and knowledge required to facilitate the implementation/operation of a Just in Time (JIT)/kanban system in a team or work area.

### Application of the Unit

This unit applies to a person who needs to monitor the operation of a JIT system and facilitate its working in a team or work area. This will involve liaison with stakeholders as well as examining the data generated. They will need to be alert to potential problems and areas for improvement.

This unit requires the application of skills associated with gathering, analysing and communicating information to facilitate implementation of the JIT system. It requires planning and organising skills and has a strong emphasis on communication and teamwork skills to ensure the JIT system is being effectively implemented. This unit also requires the ability to problem solve and take the initiative to consider performance issues and learn from experience to improve future performance.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills



unit of competency. and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Monitor the operation of the JIT system | 1.1 Track value of key measures<br>1.2 Recognise indicators of poor performance<br>1.3 Take appropriate quick fix action   |
| 2 | Liaise with relevant stakeholders       | 2.1 Regularly communicate with team or work group members regarding the operation of the JIT system<br>2.2 Review JIT key performance indicators (KPIs) with team or work group members<br>2.3 Communicate with relevant personnel up and down the value stream regarding the operation of the JIT system<br>2.4 Identify issues with stakeholders and take appropriate quick fix action   |
| 3 | Improve the JIT system                  | 3.1 Identify areas requiring improvement in the JIT system<br>3.2 Identify root cause of JIT-related problems<br>3.3 Review value of key measures<br>3.4 Recognise skill gaps in team members and other stakeholders<br>3.5 Determine any other issues in team or work group, other stakeholders and JIT system leading to poor performance indicators<br>3.6 Develop appropriate improvement solutions<br>3.7 Liaise with relevant people regarding improvement solutions |

### 3.8 Implement and/or assist with the implementation of the solutions

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying KPIs for JIT system in team or area of responsibility
- analysing the JIT/kanban implementation in the team or area and the relevant sections of the internal and external value stream, including identifying people-related needs and issues
- identifying and implementing quick fix to JIT problems
- using formal problem solving procedures (e.g. root cause analysis (RCA))
- developing formal and informal communication procedures with others in work area, team leaders, other employees and value stream members relevant to JIT implementation
- establishing sources of assistance in the organisation for people experiencing difficulty with competitive systems and practices changes
- interpreting procedures and instructions relevant to own expertise for others
- establishing KPIs for own work

### Required knowledge

Required knowledge includes:

- JIT principles relevant to operations and processes in own area or team and in the organisation generally
- procedures for making/recommending improvements
- typical reasons for delays/storages/inventories in the team or area of responsibility and methods of reducing/eliminating them
- skill gap analysis and methods of filling skill gaps
- principles of the operations process relevant to the section/team
- production data generated by the process and its application to JIT

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	Evidence should be available of the person's facilitation of the operation of the JIT system and their making of recommendations for/making improvements.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify the JIT system and practices used in their team or area of responsibility</li> <li>• identify and monitor JIT key measures</li> <li>• solve JIT-related problems to root cause</li> <li>• implement and monitor JIT-related changes to operations and practices.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p>

	Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> </ul>
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	<ul style="list-style-type: none"> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>JIT</b>	<p>JIT refers to:</p> <ul style="list-style-type: none"> <li>• a production scheduling concept that calls for any item needed at a production operation (whether raw material, finished item, or anything in between) to be produced and available precisely when needed, neither a moment earlier nor a moment later</li> </ul>
<b>Kanban</b>	<p>Kanban is a card or sheet used to authorise production or movement of an item; when fully implemented, kanban operates according to the following rules:</p> <ul style="list-style-type: none"> <li>• all production and movement of parts and material take place only as required by a downstream operation (i.e. all operations and procurement are ultimately driven by the requirements of final assembly or the equivalent)</li> <li>• the specific tool which authorises production or movement is called a kanban. The word literally means card or sign, but it can legitimately refer to a container or other authorising device. Kanban have various formats and content as appropriate for their usage (e.g. a kanban for a vendor is different than a kanban for an internal machining operation)</li> </ul> <p>Kanban is typically applied to batch type operation and the production is measured in units produced. In continuous processing organisations, production is measured in terms of production rate (e.g. kg/h, tonne/day) and rate is increased/decreased according to the flow authorisation which may be a kanban (e.g. ticket, order from a supplier) or may be a SCADA signal from a remote facility (e.g. customer tank) saying that resupply is required or similar</p>
<b>SCADA</b>	<p>SCADA refers to:</p> <ul style="list-style-type: none"> <li>• a number of systems which automatically collect critical process data, perform required mathematical</li> </ul>

	manipulations on it and then make control decisions and/or give required information to personnel for action
<b>Key measures</b>	<p>Key measures may include:</p> <ul style="list-style-type: none"> <li>• inventory levels</li> <li>• lead time</li> <li>• In Full, On Time and In Specification (IFOTIS) delivery</li> <li>• productivity/production rate</li> <li>• other measures of pull through the value stream</li> <li>• quality</li> </ul>
<b>Quick fix</b>	<p>Quick fix refers to:</p> <ul style="list-style-type: none"> <li>• action taken to immediately and cheaply control a problem, prevent it getting worse and/or ameliorate its impact, but which does not necessarily solve it long term</li> </ul>
<b>Pull system</b>	<p>Pull refers to:</p> <ul style="list-style-type: none"> <li>• a system of making to demand rather than for stock or to a forecast</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement, stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS403023A Monitor a levelled pull system of operations

### Modification History

New unit, superseding MSACMT423A Monitor a manufacturing levelled pull system\* - Not equivalent

\* Prerequisite *MSACMT280A- Undertake root cause analysis* - removed

### Unit Descriptor

This unit of competency covers the skills and knowledge required to monitor the operation of a pull system in a work area and recommend improvements.

### Application of the Unit

This unit covers the skills needed to monitor a pull operations system in a work area or team operation although knowledge of the overall pull system in the enterprise is also required. The unit is targeted at individuals, such as team leaders and senior operators, who have an overview of the work area or team operation and the ability to implement corrective action in the event of discrepancies.

The unit covers the skills needed to monitor daily working of the system, identify problems and take appropriate action on problems. The operations system may be a total demand pull system or it may be a mixed push/pull system.

This unit primarily requires the application of skills associated with using information and problem solving skills to monitor pull system and analyse discrepancies. It also requires skills in initiative and enterprise, and planning and organising to determine and act on opportunities for improvement. Aspects of self-management and learning are required to ensure own ability to improve systems.

The unit is based on manufacturing principles but can be contextualised for other types of organisations. For pull systems in an office environment the unit MSS405033A Optimise office systems to deliver to customer demand, should be used.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.



## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Monitor the pull system	1.1	Identify the pacemaker process
		1.2	Identify rate of production set by the pull system
		1.3	Determine actual rate of production at key parts of the process
		1.4	Identify types of inventories within process
		1.5	Compare actual inventories with planned inventories
		1.6	Note discrepancies between actual and planned rates and inventories
2	Take corrective action	2.1	Determine causes of discrepancies
		2.2	Determine action required to rectify causes of discrepancies
		2.3	Take appropriate action in conjunction with relevant stakeholders
3	Test/improve the pull system	3.1	Identify recurrent discrepancies
		3.2	Determine causes of discrepancies

- 3.3 Determine action required to rectify cause
- 3.4 Identify unnecessary levels of inventories
- 3.5 Discuss impacts of reduced inventories with relevant stakeholders
- 3.6 Take/initiate appropriate action to rectify recurrent discrepancies/reduce levels of unnecessary inventory
- 3.7 Monitor the system to determine the effects of changes

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying order process used by the team or in work area
- analysing processes and cycle times and determining the pacemaker process
- distinguishing between pacemaker process and bottlenecks
- distinguishing between cycle stock, buffer stock and safety stock
- leading processes to identify causes of discrepancies
- considering a range of appropriate action in the event of discrepancy, including considering the appropriateness of changes to:
  - production processes
  - cycle times
  - equipment and set-up
  - work organisation
  - training and skill development of employees
- the delegations and authority of the team members or employees in work area and team or work group leader to influence the actions required, for example:
  - actions which can be sanctioned by the individual team member
  - actions which can be sanctioned by the team or work group leader
  - actions requiring management sanction
  - actions requiring expert intervention

### Required knowledge

Required knowledge includes:

- operations and equipment used in the enterprise
- capabilities of equipment
- abilities and skills of personnel
- ultimate customer order process and relationship to demand pull for team or area
- inventories held by enterprise
- stakeholders relevant to team or area
- a range of possible actions available to address discrepancies

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• identify the demand pull system used in their area or team</li><li>• identify pacemaker process</li><li>• identify types of inventories used by team or area</li><li>• determine appropriate actions to rectify discrepancies between actual and planned rates of production</li><li>• implement and monitor changes to rectify discrepancies.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li><li>• documentation and information in relation to production, waste, overheads and hazard control/management</li><li>• reports from supervisors/managers</li><li>• case studies and scenarios to assess responses to contingencies.</li></ul>

<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"><li>• demonstration in the workplace</li><li>• workplace projects</li><li>• suitable simulation</li><li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li><li>• targeted questioning</li><li>• reports from supervisors, peers and colleagues (third-party reports)</li><li>• portfolio of evidence</li></ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• lean operations</li><li>• agile operations</li><li>• preventative and predictive maintenance approaches</li><li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP)</li></ul>
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	<p>systems, Materials Resource Planning (MRP) and proprietary systems</p> <ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Pull system</b>	<p>A pull system in a operations system is one where:</p> <ul style="list-style-type: none"> <li>• operations are done to order and not for holding large inventories of parts and completed stock</li> <li>• work flow is done according to demand pull from the next work stage</li> <li>• operations are in response to customer demand</li> </ul> <p>The pull system must be flexible and have cycle times set by parameters calculated from customer demand indicators</p>
<b>Production</b>	<p>Production in this unit is primarily used in a manufacturing sense and may include:</p> <ul style="list-style-type: none"> <li>• repetitive production of items (e.g. components and whitegoods)</li> <li>• continuous or batch production (e.g. hydrocarbons, chemicals and cement)</li> </ul>

	The term production may also be contextualised to allow for the unit to be applied to divisions or organisations supplying supporting services (e.g. transport and logistics, and utilities)
<b>Pacemaker</b>	<p>Pacemaker processes refer to:</p> <ul style="list-style-type: none"> <li>• process or scheduling points which sets the pace for the flow of operations through the enterprise. It needs to be distinguished from processes which are temporarily setting the pace for other processes because of faults, breakdowns, inefficiencies, poor design and/or waste. These should be categorised as bottlenecks and made targets for corrective action.</li> </ul>
<b>Types of inventories</b>	<p>Inventories within process may include:</p> <ul style="list-style-type: none"> <li>• cycle stock which reflects the replenishment quantity and frequency</li> <li>• buffer stock to meet demand variability and forecast errors</li> <li>• safety stock required to guard against quality and delivery failures upstream</li> </ul>
<b>Determine cause</b>	<p>Determine cause may include the individual/team leader:</p> <ul style="list-style-type: none"> <li>• analysing cause themselves</li> <li>• identifying that expert analysis is required and requesting this analysis</li> <li>• setting up an improvement team to analyse cause</li> <li>• identifying that the cause of the discrepancy is upstream or downstream of the team or area</li> </ul>
<b>Action required</b>	<p>Action required includes:</p> <ul style="list-style-type: none"> <li>• actions to align actual and planned rates of production and inventories. The actions will vary and will depend on assessment of the discrepancy and the nature of the operation</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders include:</p> <ul style="list-style-type: none"> <li>• managers</li> <li>• supervisors</li> <li>• employees</li> <li>• shareholders</li> <li>• occupational health and safety (OHS) mechanisms/representatives</li> <li>• industrial relations mechanisms/representatives</li> <li>• suppliers</li> </ul>

	<ul style="list-style-type: none"><li>• customers</li><li>• service providers</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403030A Improve cost factors in work practices**

### **Modification History**

New unit, superseding MSACMT430A Improve cost factors in work practices - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to evaluate the product or process outcomes of a team in terms of their cost components and to be able to determine, in general terms, the cost impacts of alternative actions.

### **Application of the Unit**

This unit applies to a person who is required to assess the relative costs of alternatives and use this as one of the key factors in decision making. Typical decisions include the efficient organisation of own work and that of others in a work area or within a team and the improvement of throughput and cycle times.

Decisions are made within the scope of the authority of the individual and other employees in the area or team and according to procedures.

This unit primarily requires the application of skills associated with communication and information gathering, teamwork and problem solving to analyse the cost components of work processes. Initiative and enterprise, and planning and organising are also required to identify opportunities for improved cost-efficiency. This unit also requires a degree of self-management and learning to effectively operate and maintain skills and performance.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse cost components of work area or team function	1.1	Identify cost components in the product or process
		1.2	Identify costs factors under control of area or employees in the team
		1.3	Identify causes of variability in costs
		1.4	Analyse impact of costs on production or process activities undertaken
2	Improve cost-efficiency of processes and procedures	2.1	Identify methods of improving productivity and/or reducing costs within area or team's responsibility
		2.2	Determine cost/benefit ratio of alternative methods of improving productivity and/or reducing costs
		2.3	Consult with all relevant stakeholders regarding possible changes
		2.4	Recommend changes which will increase productivity and reduce cost and variability
		2.5	Implement recommended changes in consultation with relevant stakeholders

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- identifying fixed and variable costs in products or processes
- analysing costs and determining those that can be controlled by the individuals in an area or team
- analysing costs over time and identifying variability in cost components
- determining cost/benefit ratios
- communicating and negotiating with others on changes using a variety of mediums

## Required knowledge

Required knowledge includes:

- cost components of products made
- costs concepts, such as expense, income and cost/benefit
- major cost contributors to product (e.g. energy, materials, labour and distribution, and so on) depending on the product and process)
- the difference between internally and externally controlled costs
- difference between overhead, labour and consumables

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify the scope of their own work and the team or area work and relate it to the overall flow of work in the organisation</li> <li>• express cost factors in specific terms (e.g. cost per item, process and task)</li> <li>• identify and express cost factors in basic financial terms</li> <li>• analyse variability in costs and recommend improvements</li> <li>• use cost/benefit to select preferred improvement strategies.</li> </ul>
<b>Context of and specific resources</b>	<p>Assessment of performance must be undertaken in a</p>

<b>for assessment</b>	<p>workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace project</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices,</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Cost components</b>	<p>Cost components may include:</p>

	<ul style="list-style-type: none"> <li>fixed and variable costs, such as power/energy, materials, plant and equipment, salary and wages, and office expenses (e.g. telephone)</li> <li>government taxes and charges</li> </ul>
<b>Variability in costs</b>	<p>Variability in costs should be assessed over a suitable time. The time should be sufficient to identify:</p> <ul style="list-style-type: none"> <li>fluctuations in variable costs related to different volumes of sales, production or operations</li> <li>abnormal cost fluctuations due to poor design of product or process, poor scheduling, faults, breakdowns and other waste</li> </ul>
<b>Process</b>	<p>Process includes all functions that go to meet customer requirements as well as other required functions (e.g. regulatory related functions). Examples include:</p> <ul style="list-style-type: none"> <li>design</li> <li>production</li> <li>maintenance</li> <li>logistics</li> <li>office processes</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> <li>drawings and specifications</li> <li>manuals</li> <li>formulas/recipes</li> <li>batch sheets</li> <li>temporary instructions and similar instructions provided for the smooth running of the organisation</li> <li>good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>written, verbal, computer based or in some other format</li> </ul>
<b>Benefits</b>	<p>Benefits should include:</p> <ul style="list-style-type: none"> <li>positive benefits as well as negative benefits, such as quality, safety, reliability and similar issues which may be impacted by a cost saving</li> </ul>

## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403032A Analyse manual handling processes**

### **Modification History**

New unit, superseding MSACMT432A Analyse manual handling processes - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to analyse manual handling in terms of its efficiency and safety.

### **Application of the Unit**

This unit applies to an individual who is required to examine the manual handling component of a job and improve it in terms of safety, effort required and efficiency. This may be conducted for a job performed by others or it may be for the person's own job.

This unit primarily requires the application of skills associated with problem solving, initiative and enterprise to identify safe and efficient manual handling, and planning and organising to ensure processes are implemented. This unit also requires communication with, and involvement of, others to ensure they understand the approach and to facilitate training.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Assess manual handling risks	1.1	Identify manual handling hazards in work area
		1.2	Assess risks arising from manual handling hazards
2	Analyse physical effort requirements of job	2.1	Determine basic manual handling requirements of job
		2.2	Analyse requirements in terms of components, such as lift, move, place and hold
		2.3	Analyse items to be handled in terms such as weight, size, shape or other hazards
3	Determine time/effort components of physical effort	3.1	Break required movement pattern down into movement components
		3.2	Determine time and effort requirements for movements
		3.3	Develop alternative movement patterns
		3.4	Determine time and effort requirements for alternative movements
		3.5	Determine handling aids required to assist movement
		3.6	Determine preferred movement pattern
4	Analyse the ergonomics of physical effort	4.1	Analyse the ergonomics of the preferred movement pattern
		4.2	Develop substitute movements for any movement which is not ergonomically sound
		4.3	Determine handling aids required to improve ergonomics of required movements
5	Optimise	5.1	Select movement patterns which are ergonomically



application of physical effort		sound and time and effort efficient
	5.2	Ensure all relevant people are trained to use these methods
	5.3	Ensure procedures and practices reflect the optimum methods
	5.4	Communicate with team members and involve them in development of alternatives to ensure awareness and facilitate learning

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others about work processes and jobs
- identifying ergonomically sound and unsound movements both at a general level and related to individual capability
- analysing manual handling processes
- working cooperatively with others
- demonstrating or arranging to have demonstrated ergonomically correct movements
- applying basic mathematics
- solving problems

### Required knowledge

Required knowledge includes:

- relevant occupational health and safety (OHS) Acts and regulations as applied to manual handling
- principles of job and work method design as applied to efficient and safe movement
- principles of work analysis
- principles of ergonomics/safe movement
- aids that can assist with or substitute for manual handling

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• analyse manual handling requirements and risks in jobs</li> <li>• distinguish between ergonomically sound and unsound movement</li> <li>• analyse manual handling movements and risks for an individual</li> <li>• relate manual handling requirements to job efficiency.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using some combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul>

	<p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> </ul>
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	<ul style="list-style-type: none"> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and Responsible Care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>
<b>Manual handling hazards</b>	<p>Manual handling hazards may include:</p> <ul style="list-style-type: none"> <li>• loads that pose a risk of injury</li> <li>• ergonomically unsound movements</li> <li>• hazard requirements as defined by relevant OHS Acts and regulations, industry standards and best practice</li> </ul>
<b>Ergonomically unsound movements</b>	<p>Ergonomically unsound movements may include:</p> <ul style="list-style-type: none"> <li>• awkward and repetitive movements</li> <li>• carrying, pushing, pulling or lifting of heavy loads</li> <li>• carrying or movement against hard, sharp, slippery or other difficult to grasp loads</li> </ul> <p>Ergonomically unsound movements should be assessed against the capabilities of individual workers as what is a sound movement for one worker may be unsound for</p>

	others depending on physique and individual condition
<b>Ergonomically sound movements</b>	<p>Ergonomically sound movements are movements which decrease the risk of injury. Sound movements will vary according to the load and individual. Examples include:</p> <ul style="list-style-type: none"><li>• keeping loads close to the body and near the person's centre of gravity</li><li>• using diagonal foot positions for lifting</li><li>• moving loads at waist height rather than directly from the floor</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403040A Facilitate and improve implementation of 5S**

### **Modification History**

New unit, superseding MSACMT440A Lead 5S in a manufacturing environment - Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to facilitate the implementation and improvement of the 5S by self and others in a team or work area.

### **Application of the Unit**

This unit applies to individuals who facilitate 5S in a team or work area, including implementation, monitoring and improvement. The facilitation may be undertaken by formally designated supervisory staff, such as team leaders or other individuals in a competitive systems and practices implementation role, who need to provide support and encouragement to others to facilitate the achievement of 5S outcomes in the workplace.

This unit requires the application of skills associated with communication, teamwork, problem solving, initiative and enterprise, planning and organising, and self-management in order to provide leadership in a 5S environment. This unit has a strong emphasis on planning and change management, but also requires an ability to learn from experience and feed new information back into strategies to improve performance.

For planning, implementing and leading the application of 5S in an office environment see unit *MSS403039A Facilitate and improve 5S in an office*.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Facilitate the set-up of 5S	1.1	Assist others to determine what are necessary and unnecessary items in the work area
		1.2	Assist others to determine optimum assigned location for all necessary items
		1.3	Liaise with relevant production and occupational health and safety (OHS) personnel in determining optimum locations
		1.4	Assist others to determine optimum location for unnecessary items
		1.5	Assist others to determine 5S schedule
		1.6	Ensure procedures reflect 5S practices
		1.7	Assist others to achieve the required level of skill
2	Facilitate the implementation of 5S	2.1	Ensure procedures reflect 5S practices
		2.2	Assess skill base of team or work group members in 5S and arrange for any required training
		2.3	Ensure that any damage and/or safety risks reported by the team or work group are addressed through correct mechanisms
3	Monitor 5S	3.1	Check work area for 5S implementation as part of normal routine

- 3.2 Identify non-conformances
  - 3.3 Negotiate solutions to non-conformances
- 4 Improve 5S
  - 4.1 Work with others to find areas for improvement
  - 4.2 Assist others to develop improvement solutions
  - 4.3 Facilitate the availability of resources required for the improvement solution
  - 4.4 Facilitate the implementation of the improvement solution

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with other employees and managers to engender commitment to achieving 5S outcomes, conduct formal and informal meetings and to explain 5S and related concepts
- facilitating team or work area goals, activities and communications and accessing resources
- visualising normal operational procedures in terms of flow and contribution to customer outcomes
- planning and prioritising activities
- problem solving to determine potential improvements to the 5S system
- reading and interpreting the application of operating procedures for jobs within team or target work area
- analysing work practices, procedures and 5S principles to facilitate setting up the 5S system and to identify improvements
- identifying gaps in skills and/or knowledge and options to address them

### Required knowledge



Required knowledge includes:

- principles and purpose of 5S
- methods of identifying waste in the work area, such as:
  - waste walk
  - document tagging
  - tracking/log sheets
  - spaghetti diagrams
- existing information technology and enterprise resource systems (e.g. Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems
- organisational policies, plans and procedures
- processes for identifying and addressing skill gaps
- ways of encouraging team members to find and suggest areas for improvement
- methods of identifying and evaluating options and making/recommending improvements
- methods of accessing required resources
- OHS requirements relevant to team and work area

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify the scope of the services and/or functions supplied to and by the team or work area and the deliverables expected by customers, including the ultimate customer</li> <li>• facilitate a systematic approach to implementing 5S</li> <li>• lead and motivate others in achieving 5S outcomes and making improvements to the 5S systems</li> <li>• set up systems for monitoring and improving 5S implementation</li> <li>• manage non-conformances in implementation of 5S.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p>

	<ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with

training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as SCADA software, ERP systems MRP and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> </ul>

	<ul style="list-style-type: none"> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and Responsible Care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>
<b>5S</b>	<p>5S is a system of work organisation originally developed in Japan based around a close translation of the five stages in the housekeeping approach is:</p> <ul style="list-style-type: none"> <li>• sort</li> <li>• set in order</li> <li>• shine</li> <li>• standardise</li> <li>• sustain</li> </ul>
<b>Sort</b>	<p>Sort involves keeping only what is absolutely necessary for the work processes that comprise the job and includes:</p> <ul style="list-style-type: none"> <li>• clearing the work area of all non-essential items</li> </ul> <p>Non-essential items are items not required to either produce product, conduct process or operations or make required adjustments to equipment during process or operations</p>
<b>Set in order</b>	<p>Set in order includes:</p> <ul style="list-style-type: none"> <li>• assigning required equipment and materials appropriate locations in the work area</li> </ul>
<b>Shine</b>	<p>Shine includes:</p> <ul style="list-style-type: none"> <li>• keeping the work area clean at all times. This should be carried out to a regular daily schedule against allowed time, usually at the end of the day or of a particular process</li> </ul> <p>Cleaning includes:</p> <ul style="list-style-type: none"> <li>• noting any signs of wear, damage, leakage, safety risks or other issues that require immediate attention</li> </ul>
<b>Standardise</b>	<p>Standardising includes:</p> <ul style="list-style-type: none"> <li>• activities that help maintain the order and the housekeeping standards</li> <li>• using procedures and checklists developed from a procedure</li> </ul>

<b>Sustain</b>	<p>Sustain includes:</p> <ul style="list-style-type: none"> <li>• making sure that daily activities are completed every day regardless of circumstance</li> <li>• undertaking inspections, including: <ul style="list-style-type: none"> <li>• informal inspections that should be carried out often, at least weekly</li> </ul> </li> <li>• generating continuous improvement actions from daily activities</li> <li>• formal inspections that should be carried out at least monthly</li> </ul>
<b>Items in work area</b>	<p>Items in work area may include:</p> <ul style="list-style-type: none"> <li>• tools</li> <li>• jigs/fixtures</li> <li>• materials/components</li> <li>• plant and equipment</li> <li>• manuals</li> <li>• personal items (e.g. bags, lunch boxes and posters)</li> <li>• safety equipment and personal protective equipment</li> <li>• other items which happen to be in the work area</li> </ul>
<b>Team</b>	<p>The term team is used to apply to all individuals in the target work area who are involved in the implementation of 5S. The team may or may not be a formally designated team working to a team leader</p>
<b>Work area</b>	<p>The work area includes:</p> <ul style="list-style-type: none"> <li>• all areas where aspects of the job are performed and that are under the direct control of the employee. In a team environment 5S should be applied to all work areas under the control of the team</li> </ul>
<b>Target work area</b>	<p>The target work area may be identified as a physical and/or virtual work space:</p> <ul style="list-style-type: none"> <li>• used by a person, a team or a cross-functional group</li> <li>• common to part/s of a process or value stream (already defined)</li> <li>• shared by people who undertake a defined procedure or set of procedures</li> <li>• needed to support a particular function</li> </ul>
<b>Appropriate place</b>	<p>Appropriate places may include areas designated for:</p> <ul style="list-style-type: none"> <li>• recycling</li> <li>• rubbish removal</li> <li>• staff room/lunch room/kitchen</li> </ul>

	<ul style="list-style-type: none"><li>• storage</li><li>• holding area until status is confirmed</li></ul>
<b>Optimum assigned location</b>	The optimum assigned location may include: <ul style="list-style-type: none"><li>• making changes to the layout of furniture, equipment and personnel in order to facilitate the smooth and continuous flow of work through process steps taking into account OHS considerations</li></ul>
<b>Non-conformance</b>	Non-conformance includes: <ul style="list-style-type: none"><li>• incorrect or incomplete application of 5S procedures, including any daily tasks, scheduled inspections and continuous improvement procedures</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS403051A Mistake proof an operational process**

### **Modification History**

New unit, superseding MSACMT451A Mistake proof a production process - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to make changes to own and others work in a work area which prevents errors and/or backsliding to a pre-improvement level of practice.

### **Application of the Unit**

This unit applies to a person who needs to analyse a process that a team is responsible for and determine methods of mistake proofing it (e.g. ensuring it only produces product within an acceptable range or error-free transport and storage of goods). The person will typically be a technical expert, team leader or be in a role where they have sufficient technical understanding of processes in their own work and that of others to be able to mistake proof the production process in their area. After improvement activities have been undertaken these improvements need to be sustained.

This unit requires the application of skills associated information gathering and analysis. Initiative, enterprise and problem solving are also required to identify mistakes and determine strategies for eliminating them. This unit also requires communication and teamwork skills to ensure mistake proofing strategies are implemented and self-management and learning skills to continually reflect on and integrate feedback about the effectiveness of strategies.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse process	1.1	Identify sources of variability/non-conformance in the process
		1.2	Identify critical control points in process
		1.3	Analyse causes of variability/non-conformance
2	Develop preventative techniques/systems	2.1	Liaise with team members and other people to develop mistake proof options for performing operation
		2.2	Test and validate mistake proofing options
3	Implement permanent fix	3.1	Liaise with relevant people to have systems/procedures changed to implement solution
		3.2	Liaise with relevant people to implement the solution
		3.3	Liaise with relevant people to ensure self and others in the team or work area have an appropriate skills set
		3.4	Follow through to ensure implementation occurs
4	Monitor implementation	4.1	Critically observe the implementation
		4.2	Compare the results of the implementation against the expected outcomes
		4.3	Modify solution to improve outcomes



- |   |                   |     |  |
|---|-------------------|-----|--|
|   |                   | 4.4 | Ensure procedures reflect change   |
|   |                   | 4.5 | Ensure training/assessment reflects change                               |
|   |                   | 4.6 | Audit change at agreed period/cycle                                      |
|   |                   | 4.7 | Take action on any observed deviation                                    |
| 5 | Seek improvements | 5.1 | Observe changes  |
|   |                   | 5.2 | Analyse process again, if required, to ensure improvements are sustained |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with team or work group members, technical support personnel and other relevant staff
- explaining mistake proofing and related concepts
- facilitating input of others and encouraging acceptance of changes
- analysing and visualising operations in terms of flow and contribution to customer outcomes
- solving problems to determine root cause of errors and possible solutions
- analysing and interpreting information about errors and mistake proofing options in terms of cost, feasibility, regulations and value to the customer
- suggesting design changes to operations and products that eliminate the potential for errors
- suggesting mechanisms or procedures that warn of errors where operations cannot be designed to eliminate errors,

### Required knowledge

Required knowledge includes:

- mistake proofing concepts, including, in priority order:
  - eliminate the possibility of the error via changes to the process
  - prevent the error from occurring via physical or virtual barriers
  - reduce likelihood of the error by encouraging correct action

- mitigate the impact of the error if it does occur
- understanding of processes undertaken by team
- factors in the processes which may cause variability
- methods of controlling the variability in the process
- mistake proofing methods relevant to the process/product

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse variability and non-conformances</li> <li>• identify, analyse and evaluate information from a variety of sources to identify errors and options for mistake proofing</li> <li>• facilitate implementation of mistake proofing activities that reduce waste</li> <li>• facilitate sustaining the mistake proofing activities.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> </ul>

	<ul style="list-style-type: none"> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related</li> </ul>
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	<p>operations control systems</p> <ul style="list-style-type: none"> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Mistake proofing</b>	<p>Mistake proofing is based on the concept of zero defects. The first priority is to eliminate the possibility of an error occurring. However, where this is not feasible mistake proofing can be used to reduce the occurrence of errors and/or to minimise their impact.</p> <p>Mistake proofing should target an error in the following priority order:</p> <ul style="list-style-type: none"> <li>• eliminate the possibility of the error via changes to the process</li> <li>• prevent the error from occurring via physical or virtual barriers,</li> <li>• reduce likelihood of the error by encouraging correct action (e.g. through warning systems)</li> <li>• mitigate the impact of the error if it does occur</li> </ul> <p>Mistake proofing is also called error proofing or baka-yoke or poka-yoke</p>
<b>Options for mistake proofing</b>	<p>Factors to consider when prioritising options for mistake proofing will vary according to the process and may include:</p> <ul style="list-style-type: none"> <li>• success rate in eliminating errors</li> </ul>

	<ul style="list-style-type: none"><li>• feasibility</li><li>• skills required by employees</li><li>• cost</li><li>• capacity to reduce waste</li></ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"><li>• all work instructions</li><li>• standard operating procedures</li><li>• formulas/recipes</li><li>• batch sheet</li><li>• temporary instructions and similar instructions provided for the operation of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li><li>• government regulations</li></ul> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer-based or in some other format</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS404050A Undertake process capability improvements

### Modification History

New unit, superseding MSACMT450A Undertake process capability improvements\* - Equivalent

\* New prerequisite *MSS404052A Apply statistics to operational processes* superseding MSACMT452A Apply statistics to processes in manufacturing

### Unit Descriptor

This unit of competency covers the skills and knowledge required to make process capability improvements, including analysing data from the process, developing improvements to eliminate variation due to assignable causes, and then implementing actions.

### Application of the Unit

This unit applies to a person who reviews a range of process capability data and information, makes/arranges for changes to be made to procedures, equipment or process and then recalculates the process capability and monitors resulting improvement actions. The person will typically be a technical expert, team leader or be in a role where they have sufficient technical understanding of processes in their own work and that of others to be able to suggest and justify process capability improvements.

Process capability may have been determined using either a six sigma or three sigma processes. This unit applies to the application of statistical methods and the determination of capability based on those methods. Other related units may be *MSS404052A Apply statistics to operational processes* and *MSS404053A Use six sigma techniques*

This unit primarily requires the application of skills associated with communication, information gathering and analysis. Initiative, enterprise and problem solving are also required to identify opportunities to improve process capacity. This unit also requires aspects of self-management and learning to validate own analysis.

For a qualitative approach to improvement (one not using statistics) see *MSS403051A Mistake proof an operational process*.

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MSS404052A Apply statistics to operational processes

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Obtain required data	1.1	Identify process for study
		1.2	Obtain/organise process to obtain required data/information
2	Analyse information	2.1	Analyse data and determine assignable causes
		2.2	Develop possible improvements to eliminate assignable causes
		2.3	Incorporate own experience and learning into proposed process improvement proposals
		2.4	Develop process improvement proposals
3	Improve process capability	3.1	Obtain required authorities to implement improvements
		3.2	Liaise with relevant people to implement improvements
		3.3	Obtain/organise required data for improved process

- 3.4 Recalculate process capability
- 3.5 Implement revised data collection/processing and new capability information
- 3.6 Monitor improvement actions and make adjustments, as necessary

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- performing relevant mathematical operations
- identifying and using relevant statistical methods
- communicating and explaining data- related changes and procedures to individuals and groups
- negotiating with other employees and managers on proposed improvement actions
- analysing procedures and data to establish variation
- solving problems to root cause where assignable cause of variation is not obvious
- working in a team
- using computer software relevant to required analyses and process

### Required knowledge

Required knowledge includes:

- data collection methods
- data processing techniques required
- variability and normal distribution
- three sigma or six sigma processes, as relevant
- random and non-random results (recognition of assignable causes)
- causes of different types of non-random results
- causes of random variation
- process understanding sufficient to translate the data into variations in the process and determine methods of controlling them



## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse process information</li> <li>• calculate process capability/trial limits</li> <li>• improve process capability (or organise for it to be improved)</li> <li>• analyse revised process information and recalculate process capability.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will</p>

	<p>be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> </ul>
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	<ul style="list-style-type: none"> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Process capability</b>	<p>Process capability is:</p> <ul style="list-style-type: none"> <li>• the measurable ability of a process to reliably produce within calculated limits (the limits depend on the variation of the process)</li> </ul>
<b>Variation</b>	<p>All processes have variation. The approach in this unit is to separate random variation (no assignable cause) from non-random variation (which has an assignable cause). By finding and eliminating assignable causes, total variation is reduced and process capability will be improved</p>
<b>Six sigma</b>	<p>Six sigma refers to:</p> <ul style="list-style-type: none"> <li>• a statistical tool for recording defects and determining capability. Six sigma limits equate to 3.4 defects per million opportunities for each product or service transaction. Six sigma is also used as a general term covering a competitive systems and practices approach. Six sigma training typically covers several units of competency in this Training Package</li> </ul>
<b>Three sigma</b>	<p>Three sigma refers to:</p> <ul style="list-style-type: none"> <li>• a traditional statistical process control. Three sigma limits equate to 3 defects per thousand opportunities for each product or service transaction</li> </ul>
<b>Required data</b>	<p>The calculation of three sigma or six sigma limits requires process data. The data required depends on the nature of the limits being calculated</p>
<b>Assignable cause</b>	<p>Any non-random variation is said to have an 'assignable cause'. The methods of data analysis common to statistical capability analysis as well as other methods of</p>

	root cause analysis should be used to determine the cause of this non-random variation
<b>Improved process capability</b>	<p>Improvements to process capability result from eliminating the causes of non-random variation. The improvements made may be:</p> <ul style="list-style-type: none"><li>• as a result of continuous improvement with the process capability being recalculated periodically</li><li>• as a result of an improvement project with the process capability recalculated as part of that project</li></ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"><li>• work instructions</li><li>• standard operating procedures</li><li>• formulas/recipes</li><li>• batch sheets</li><li>• temporary instructions and similar instructions provided for the smooth running of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li><li>• government regulations</li></ul> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer-based or in some other format</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS404052A Apply statistics to operational processes**

### **Modification History**

New unit, superseding MSACMT452A Apply statistics to processes in manufacturing - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply statistical theory and principles to the analysis and control of processes and operations.

### **Application of the Unit**

This unit applies to a person working in an organisation applying statistical process control on processes or operations. The statistical process control will usually be used to monitor the processes or operations and determine when action needs to be taken. The appropriate action will then be taken in accordance with standard procedures.

The unit includes applying knowledge of frequency distribution and variation to the data/chart to distinguish between random and non-random variation and assumes understanding of the process and/or equipment to help interpret those results.

This unit primarily requires the application of skills associated with gathering and analysing data and communicating statistical information to others. This unit also has a strong emphasis on problem solving, initiative and enterprise, planning and organising, and self-management to solve problems and manage processes.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Collect process data	1.1	Interpret sampling scheme
		1.2	Obtain measurements in accordance with standard procedures
		1.3	Handle data, as required
2	Interpret data	2.1	Plot data on appropriate control chart
		2.2	Distinguish between random and non-random patterns of results
		2.3	Identify results outside the control limits
		2.4	Recognise situations requiring action
		2.5	Take appropriate action in accordance with standard procedures
		2.6	Determine cost of non-conformance
3	Calculate control limits	3.1	Consult relevant stakeholders to determine appropriate limits
		3.2	Use relevant methods to calculate/revise control limits
		3.3	Plot limits on control chart
		3.4	Explain impact of limit to relevant stakeholders

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- applying a range of sampling procedures
- analysing samples and data for variation, relevance, reliability and representativeness
- problem solving the causes of variation in a process
- communicating with other employees to obtain samples/data and to explain results and limits
- plotting or documenting results
- undertaking calculations, including:
  - basic arithmetic functions
  - mean, range, mean of means, standard deviation (using appropriate calculation aids)
- using statistics to support process and operations control

### Required knowledge

Required knowledge includes:

- sampling techniques
- purpose of sampling and measurement
- random, systematic and stratified sampling
- purpose of replication of data for statistical control
- samples, populations, finite and infinite populations and the differences
- methods of calculating means, standard deviations and the like and their purpose in statistical control
- the meaning of broad/narrow frequency distributions/range/standard deviations and skewed distributions in process terms
- concept of limits, including:
  - 1 sigma warning limits
  - 2 sigma warning limits
  - 3 sigma control limits
  - 6 sigma limits
- types of control charts and their applications to different types of process/product and for different purposes
- process causes of variation and typical cause types of non-random variation
- non-process (e.g. measurement) causes of variation
- recognition of stable and unstable processes
- causes of stability/instability in the process

- calculation of control limits/process capability and the applications of different control limits
- the standard distribution curve and confidence limits

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• follow sampling procedures</li> <li>• apply basic statistical processes</li> <li>• analyse data to identify variations and non-conformances</li> <li>• plot or document results.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> </ul>



	<ul style="list-style-type: none"> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> </ul>
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	<ul style="list-style-type: none"> <li>breakthrough improvement (kaizen blitz)</li> <li>cause/effect diagrams</li> <li>overall equipment effectiveness (OEE)</li> <li>takt time</li> <li>process mapping</li> <li>problem solving</li> <li>run charts</li> <li>standard procedures</li> <li>current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Sampling scheme</b>	<p>Sampling scheme may include:</p> <ul style="list-style-type: none"> <li>sampling for attributes or sampling for variables</li> <li>batch, continuous or custom made products</li> <li>number of items/samples</li> <li>size of sample</li> <li>timing of sampling</li> <li>location of sampling points</li> <li>type of sample</li> <li>number/type of measurements to be done on each sample</li> <li>sampling equipment</li> <li>measurement/testing equipment/methods</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> <li>formulas/ recipes</li> <li>batch sheets</li> <li>temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>written, verbal, computer-based or in some other</li> </ul>

	format
<b>Handle data</b>	<p>Handle data may include:</p> <ul style="list-style-type: none"> <li>• calculating means, ranges, mean of means and standard deviations (using appropriate calculation aids)</li> <li>• entering data into a software package</li> <li>• recording data either in writing or electronically</li> <li>• other required manipulations of the data</li> </ul>
<b>Control chart</b>	<p>Control charts may include:</p> <ul style="list-style-type: none"> <li>• run</li> <li>• tally</li> <li>• mean/range</li> <li>• attributes</li> <li>• other relevant charts</li> </ul>
<b>Random</b>	Random variation is the term used in statistical control to refer to those variations for which no cause can be found
<b>Non-random</b>	Non-random (also called identifiable cause, assignable cause or special cause) are those variations for which a cause can be found and so the cause of the variation eliminated. Non-random variation may also be used to predict possible breaches of the control limits
<b>Control limits</b>	Control limits (also referred to as process capability) are those limits within which the process will operate if it is 'under control'
<b>Cost of non-conformance</b>	<p>Cost of non-conformance includes:</p> <ul style="list-style-type: none"> <li>• reprocessing/rework</li> <li>• expediting</li> <li>• unplanned service</li> <li>• excess inventory</li> <li>• complaint handline</li> <li>• downtime</li> <li>• returns</li> <li>• scrap</li> <li>• labour costs</li> <li>• material costs</li> <li>• infrastructure costs/overhead</li> <li>• utility costs</li> </ul>
<b>Appropriate limits</b>	Appropriate limits may include:

	<ul style="list-style-type: none"><li>• 1 sigma warning limits</li><li>• 2 sigma warning limits</li><li>• 3 sigma control limits</li><li>• 6 sigma limits</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS404060A Facilitate the use of planning software systems in a work area or team**

### **Modification History**

New unit, superseding MSACMT460A Facilitate the use of planning software systems in manufacturing\* - Not equivalent

\* Prerequisite *MSACMT260A Use planning software systems in manufacturing* - removed

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to facilitate the use of planning software in an organisation in a person's work area or team. These systems are known by various generic names, such as Enterprise Resource Planning (ERP), Materials Resource Planning (MRPII, MRP III etc.) or by proprietary names.

### **Application of the Unit**

This unit applies to a person who will access the planning software system for their own work, but will also need to provide support and organise skill development programs for their team or work group members. The person will typically be a technical expert, team leader or be in a role where they have sufficient technical understanding of processes in their own work and that of others to be able to facilitate the use of the planning software system.

The planning software system will be used routinely in the work of the team or work group.

This unit primarily requires the application of skills associated with using communication technology and supporting team use of planning software. Problem solving, initiative and enterprise, and planning and organisational skills are required to ensure that planning software is used efficiently. This requires aspects of learning and self-management to ensure own performance and that of the team.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Identify scope of planning software	1.1	Identify categories of information held by planning software
		1.2	Identify information categories relevant to team and area processes
		1.3	Identify range of information able to be provided to planning software by team or work group
		1.4	Identify range of information able to be provided to team or work group by planning software
2	Communicate using the planning software system	2.1	Send and receive information using planning software
		2.2	Send and receive messages using planning software
3	Make decisions using planning software	3.1	Interrogate the planning software system to find required current, historical or predicted information
		3.2	Take actions appropriate to the information in accordance with procedures
4	Monitor the use of	4.1	Routinely monitor planning software information

planning software	4.2	Review performance and use of planning software with team
5	Support others to use planning software	5.1 Regularly communicate with team or other work group members, both using planning software and face to face
		5.2 Identify improvements required
		5.3 Take appropriate actions to implement improvements

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- entering and receiving information via planning software terminals
- communicating with team and organisation planning software support personnel
- engaging and motivating team in use of planning software
- identifying team or work group area information requirements
- identifying scope of information relevant to team and area available in planning software by categories
- planning and organising improvements in team's use of planning software

### Required knowledge

Required knowledge includes:

- hierarchy of planning software system and operation
- information available from/through the planning software system
- query facilities and information analysis capabilities offered by planning software
- support/training/skill development mechanisms available for access by team members

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify team or work group area information requirements and relate to planning software categories</li> <li>• lead and motivate others in using planning software</li> <li>• ensure information sent to planning software is accurate and appropriate</li> <li>• obtain regular and one-off information from planning software</li> <li>• make decisions using planning software generated information.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<p><b>Method of assessment</b></p>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul>



	<p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, ERP systems, MRP and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> </ul>
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	<ul style="list-style-type: none"> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Planning software</b>	<p>Planning software is a general term applied to a number of software systems which integrate a range of business information, such as:</p> <ul style="list-style-type: none"> <li>• sales/order taking</li> <li>• finance/accounting</li> <li>• logistics</li> <li>• maintenance</li> <li>• human resources</li> <li>• production</li> </ul> <p>It is frequently referred to by names such as ERP or MRP/MRPII. In some cases it can be integrated with engineering applications, such as SCADA systems. In such cases the unit MSS402061A Use SCADA systems in operations may also be required</p>
<b>Information and messages</b>	<p>Information and messages able to be sent and received via the planning software will vary between programs and organisations. This unit assumes that a range of discretion is available to the team leader over the information and messages that can be sent or received. Examples of information and message categories include:</p> <ul style="list-style-type: none"> <li>• orders</li> <li>• production/operations processes</li> <li>• scheduling (e.g. daily/weekly)</li> <li>• finance and accounting</li> <li>• human resources (e.g. rosters, reserves, training completed and scheduled)</li> <li>• quality requirements</li> <li>• customers</li> <li>• suppliers</li> </ul>

<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"><li>• sales outlet/representative</li><li>• information gathering, data analysis and research</li><li>• product design</li><li>• raw material sourcing</li><li>• intermediate processing</li><li>• final assembler/collation/preparation</li><li>• support services (e.g. accounting, finance and legal)</li><li>• storage and delivery to customer</li><li>• after market support</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS404061A Facilitate the use of SCADA systems in a team or work area**

### **Modification History**

New unit, superseding MSACMT461A Facilitate SCADA systems in a manufacturing team or work area\* - Not equivalent

\* Prerequisite *MSACMT261A Use SCADA systems in manufacturing* - removed

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required by a team leader or technical expert to personally use and facilitate the use of System Control and Data Acquisition (SCADA), or other similar systems, and support the team in their use of SCADA.

### **Application of the Unit**

This unit applies to team leaders and others who are providing guidance and support to assist employees to use SCADA. The person will access the SCADA system for their own work, but will also need to provide support and organise skill development programs for their team members.

This competency is also relevant to maintenance personnel using a SCADA system to coordinate maintenance activities.

This unit primarily requires the application of skills associated with using communication technology and supporting team use of SCADA systems. Problem solving, initiative and enterprise, and planning and organisational skills are required to ensure that system is used efficiently. This requires aspects of learning and self-management to ensure own performance and that of the team.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify scope of SCADA system	1.1	Identify categories of information held in and control options of SCADA system relevant to team or area
		1.2	Identify range of information able to be provided to SCADA system by team
		1.3	Identify range of information able to be provided to team by SCADA system
		1.4	Identify team or area functions impacted by SCADA system
2	Communicate using SCADA system	2.1	Send and receive information using SCADA
		2.2	Send and receive messages using SCADA
3	Make decisions using SCADA	3.1	Interrogate the SCADA system to find required current, historical or predicted information
		3.2	Take actions appropriate to the information
4	Monitor the use of SCADA	4.1	Routinely monitor SCADA information
		4.2	Identify poor uses of SCADA system within team and system inadequacies
		4.3	Identify system improvements required

- |   |                           |     |  |
|---|---------------------------|-----|--|
|   |                           | 4.4 | Take appropriate action to improve SCADA system and its use                            |
| 5 | Support team use of SCADA | 5.1 | Regularly communicate with team, both using SCADA-based communication and face to face |
|   |                           | 5.2 | Identify skill improvement needs   |
|   |                           | 5.3 | Identify team members who require additional support                                   |
|   |                           | 5.4 | Take appropriate action to provide support   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- entering and receiving information via SCADA terminals
- communicating with team and organisation SCADA support personnel
- engaging and motivating team in use of SCADA system
- identifying team or work area information requirements
- identifying scope of team or area processes controlled by SCADA system
- planning and organising improvements in team's use of SCADA

### Required knowledge

Required knowledge includes:

- hierarchy of SCADA system and operation
- information available from and controls exercised by/through the SCADA system
- query, control and other facilities and information offered by SCADA
- support/training/skill development mechanisms available for access by team member

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify team or area information and operations requirements and relate to SCADA system</li> <li>• lead and motivate others in using SCADA system</li> <li>• obtain regular and one-off information from SCADA system</li> <li>• make decisions using SCADA generated information.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will</p>

	<p>be combined with targeted questioning to assess the underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> </ul>
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	<ul style="list-style-type: none"> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>SCADA</b>	<p>SCADA is a general term applied to a number of systems which automatically collect critical process data, perform required mathematical manipulations on it and then make control decisions and/or give required information personnel for action.</p> <p>SCADA systems are often used in manufacturing but can also be used in other industries. In the continuous sector, the SCADA system is sometimes integrated into other sophisticated computer control systems, such as Distributed Control System (DCS) and these systems do merge in advanced systems. These organisations may simply refer to their SCADA as the DCS or other similar term (such as the proprietary name of the computer system)</p>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/ collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS404081A Undertake proactive maintenance analyses**

### **Modification History**

New unit, superseding MSACMT481A Undertake proactive maintenance analyses - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to undertake the most common forms of analyses associated with predictive/preventative/reliability centred maintenance strategies.

### **Application of the Unit**

This unit applies to a technical expert (usually an engineer, technician or tradesperson) who is required to undertake analyses for the purpose of predictive/preventative/reliability centred maintenance as part of a competitive systems and practices strategy.

This unit primarily requires the application of skills associated with communication, teamwork, problem solving, initiative and enterprise, and planning and organising in order to undertake maintenance analyses. This is normally done in the context of using computer technology, and requires aspects of learning and self-management to ensure team involvement and facilitation of learning.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Liaise with operator	1.1	Establish a relationship with the operator of equipment/plant
		1.2	Ensure the operator has the required skills and resources to keep the equipment/plant clean
		1.3	Ensure the operator is able to effectively monitor the operation of the equipment/plant
		1.4	Regularly communicate with operator about the overall equipment effectiveness (OEE) of their equipment/plant
		1.5	Involve operator, team leader and other key personnel in identification of skill needs and means of skill acquisition to fill any identified gaps
2	Analyse history	2.1	Analyse mean time between failures (MTBF) from maintenance records
		2.2	Analyse performance data of the equipment/plant
		2.3	Identify causes of changes to historic trends/status
		2.4	Determine methods of ensuring causes of improvements and resolution of deterioration are locked in
3	Undertake failure mode effects analysis (FMEA) or similar failure effects analysis	3.1	Undertake analysis
		3.2	Record results of analysis
		3.3	Investigate methods of eliminating possibility of failure and/or minimising the impact of the failure
		3.4	Liaise with operator, team leader and other key personnel regarding possible solutions

- |   |   |     |   |
|---|---|-----|---|
|   |   | 3.5 | Select most appropriate solution  |
|   |   | 3.6 | Implement selected solutions  |
| 4 | Undertake condition monitoring analysis | 4.1 | Obtain data for condition monitoring analysis   |
|   |   | 4.2 | Interpret condition monitoring data   |
|   |   | 4.3 | Predict required maintenance type and timing from condition monitoring data   |
|   |   | 4.4 | Liaise with operator, team leader and other key personnel regarding implications of condition monitoring report     |
|   |   | 4.5 | Involve team members in development of changes to maintenance strategy to ensure awareness, learning and commitment |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with operators and team leaders in a variety of situations and with different media
- adapting personal communication strategy to different levels of operator and team leader literacy and numeracy
- working in formal and ad-hoc teams to undertake proactive maintenance related analyses
- analyse data to determine trends, variations, equipment history and to prioritise methods of eliminating or minimising equipment failure
- solving problems to root cause
- applying basic arithmetic and statistical methods
- planning for effective data collection
- reading and interpreting engineering specifications/drawings
- reading and interpreting charts and diagrams
- using information system terminals and computer
- recording data in hard or soft formats

## Required knowledge

Required knowledge includes:

- cleaning needs, techniques and principles of equipment in area of responsibility
- methods of assessing operator and maintenance skill gaps and filling them
- techniques for determining MTBF or similar
- techniques for undertaking FMEA or similar
- underpinning principles of competitive systems and practices strategies being implemented and how to adapt them to maintenance
- root cause analysis
- techniques to analyse condition monitoring data

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify and analyse data and other information on the historical performance of equipment</li> <li>• involve operators, maintenance and other stakeholders in decisions on proactive maintenance strategies</li> <li>• identify root cause of failure and deterioration in equipment performance</li> <li>• select and implement failure elimination or minimisation solutions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to</li> </ul>

	<p>production, waste, overheads and hazard control/management</p> <ul style="list-style-type: none"> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> </ul>
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	<ul style="list-style-type: none"> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• OEE</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>OEE</b>	<p>OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is:</p> $OEE = availability \times performance \times quality\ rate$ <p>where:</p> <ul style="list-style-type: none"> <li>• availability takes into account losses due to breakdown, set up and adjustments</li> <li>• performance takes into account losses due to minor stoppages, reduced speed and idling</li> <li>• quality rate takes into account losses due to rejects, reworks and start-up waste</li> </ul>



<b>MTBF</b>	<p>MTBF is one key measure of the effectiveness of a maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MTBF is reducing, then it is an indicator that the maintenance regime is failing.</p> <p>There are many possible causes of any problem. Eliminating some will have no impact, others will ameliorate the problem. However, elimination of the root cause will eliminate the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem.</p> <p>Depending on the equipment, operations and procedures of the organisation, alternative statistical records of maintenance and maintenance related events may be substituted for MTBF providing they relate strategies for improving OEE.</p>
<b>FMEA</b>	<p>FMEA is a systematic approach that identifies potential failure modes in a system, product, or operations/assembly operation caused by either design or operations/assembly process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring.</p> <p>Some industry sectors have highly adapted forms of FMEA and may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification.</p> <p>HAZOP is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to process stability.</p>
<b>Condition monitoring</b>	<p>In this unit condition monitoring is used to describe the process of analysing the implications of condition monitoring data for proactive maintenance, whether it be obtained from non-destructive testing (NDT) reports, visual assessment by experts, diagnostic reports obtained from SCADA or other enterprise or equipment software and product or process quality analyses. It does not require the actual undertaking of the NDT or condition monitoring assessment or test. If this is required appropriate units from other Training Packages will be</p>

	required.
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS404082A Assist in implementing a proactive maintenance strategy**

### **Modification History**

New unit, superseding MSACMT482A Assist in implementing a proactive maintenance strategy - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required by a maintenance person to assist in the implementation of a proactive maintenance strategy in an organisation. This unit includes the interaction between a maintenance worker and operators, as appropriate.

### **Application of the Unit**

This unit applies to a maintenance person in an organisation that has adopted or is implementing total preventative/productive maintenance (TPM), reliability centred maintenance (RCM) or similar strategies. As part of this, the maintenance person is expected to assist in the implementation by determining appropriate maintenance related schedules and also by providing maintenance related assistance to non-maintenance personnel, such as assisting production personnel to fulfil their role in the TPM/RCM strategy.

This unit requires the application of skills associated with problem solving and initiative and enterprise in order to analyse maintenance requirements. Communication, teamwork and planning and organising skills will be required to implement reliability strategies. This requires aspects of self-management to ensure improvement of own performance and learning.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Develop components of reliability strategy for a work/plant area	1.1	Determine manufacturer's recommended inspection, servicing and related schedules for relevant plant
		1.2	Consult with relevant people with regard to appropriate inspections, services and schedules
		1.3	Discuss any conflicts with relevant people and seek resolution of conflicts
		1.4	Develop schedules in liaison with relevant people
		1.5	Identify inspections and servicing which may be done by operations personnel in liaison with relevant stakeholders
2	Assess current practice for maintenance implications	2.1	Identify the overall equipment effectiveness (OEE) or other organisation targets for equipment/plant
		2.2	Evaluate procedures for plant/equipment reliability implications
		2.3	Discuss current practices with relevant people to determine any plant/equipment reliability implications
		2.4	Recommend changes to improve plant/equipment reliability in accordance with procedures
3	Assist in implementing the reliability strategy	3.1	Arrange for schedules to be incorporated in relevant work plans
		3.2	Identify training needs in discussion with relevant

personnel

- 3.3 Assist personnel to develop required skills for inspections/servicing within scope of authority
- 3.4 Collect data/information as required by own work plan
- 3.5 Compare data/information with performance indicators
- 3.6 Recommend improvements to reliability strategy in accordance with procedures

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- explaining concepts and processes of chosen proactive maintenance strategy used by the organisation and distinguishing from traditional (breakdown) maintenance strategies
- communicating with operators, other maintenance personnel, team leaders and technical experts in a variety of situations and using different media
- adapting personal communication strategy to different levels of operator and team leader literacy and numeracy
- working in formal and ad-hoc teams to implement proactive maintenance
- solving problems to root cause
- planning proactive maintenance tasks to fit in with maintenance and production schedules and the needs of other staff
- assessing the ability of operations personnel with regard to inspections and servicing of equipment
- reading and interpreting charts and diagrams, manufacturer manuals and specifications and operating procedures

### Required knowledge

Required knowledge includes:

- requirements of the proactive maintenance strategy being implemented
- operating principles and procedures for equipment/plant subject to proactive maintenance strategy
- purpose and processes for data collection in proactive maintenance strategies
- procedures relevant to own job and organisation implementation of proactive maintenance

- methods of making/recommending improvements

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• source information from manuals and other technical documentation or software</li> <li>• effectively communicate with users on equipment operational and maintenance history</li> <li>• develop schedules for maintenance activities including seeking technical assistance, where appropriate</li> <li>• differentiate between proactive and traditional maintenance strategies.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> </ul>

	<ul style="list-style-type: none"> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and</li> </ul>
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	<p>analysis</p> <ul style="list-style-type: none"> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• OEE</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise, the work organisation, culture</li> <li>• regulatory environment and the industry sector</li> </ul>
<b>TPM</b>	TPM is an application of total quality management to maintenance with the intention of increasing reliability, getting it right first time and increasing OEE
<b>RCM</b>	RCM moves maintenance from reactive, or even planned/programmed, towards a focus on uptime and OEE
<b>Similar strategies</b>	<p>Similar strategies may include:</p> <ul style="list-style-type: none"> <li>• mean time between failure (MTBF) which is one key measure of the effectiveness of a maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MTBF is reducing, then it is an indicator that the maintenance regime is failing</li> <li>• failure mode and effects analysis (FMEA) which is a systematic approach that identifies potential failure modes in a system, product, or equipment based operations caused by either design or operation/process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring</li> <li>• industry sectors have highly adapted forms of FMEA</li> </ul>



	<p>and which may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification. HAZOP is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to process stability</p> <ul style="list-style-type: none"> <li>condition monitoring which often involves quite sophisticated monitoring of equipment, including such things as vibration monitoring, instrumental analysis of lubricating oil, and so on, to determine the current state of the equipment, monitor the change in this condition and predict when it needs servicing/maintenance to maintain reliability.</li> </ul>
<b>OEE</b>	<p>OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is:</p> $OEE = \text{availability} \times \text{performance} \times \text{quality rate}$ <p>where:</p> <ul style="list-style-type: none"> <li>availability takes into account losses due to breakdown, set-up and adjustments</li> <li>performance takes into account losses due to minor stoppages, reduced speed and idling</li> <li>quality rate takes into account the losses due to rejects, reworks and start-up waste</li> </ul>
<b>Uptime</b>	<p>Uptime refers to the overall availability of the plant (it is the inverse of downtime) or the unavailability of the plant. Ideal uptime is 100%</p>
<b>Inspection</b>	<p>Inspection may include:</p> <ul style="list-style-type: none"> <li>reading dials, gauges and meters</li> <li>observations, including those using sight, hearing, smell and feel</li> <li>observations of product quality/faults/rejects</li> </ul>
<b>Servicing</b>	<p>Servicing may include:</p> <ul style="list-style-type: none"> <li>cleaning</li> <li>lubricating</li> <li>topping up</li> <li>adjusting</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>work instructions</li> <li>standard operating procedures</li> </ul>

	<ul style="list-style-type: none"><li>• formulas/recipes</li><li>• batch sheets</li><li>• temporary instructions and similar instructions provided for the smooth running of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li><li>• government regulations</li></ul> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer based or in some other format</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# **MSS405001A Develop competitive systems and practices for an organisation**

## **Modification History**

New unit, superseding MSACMS600A Develop a competitive manufacturing system - Equivalent

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop new strategies for competitive systems and practices or make improvements to existing systems and practices.

## **Application of the Unit**

This unit applies to a manager, technical specialist or similar in an organisation implementing competitive systems and practices, or in an organisation wishing to embark on the competitive systems and practices path. The person needs to be able to analyse the needs of the organisation and develop strategies and systems for effective implementation and continuous improvement of competitive systems and practices in the organisation.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Problem solving, initiative and enterprise, and planning and organising are required to determine effective competitive systems and practices strategies for the organisation. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into competitive systems and practices strategies.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine appropriate analytical techniques	1.1	Liaise with key stakeholders to determine objectives of operations strategy
		1.2	Examine current operations to determine major areas requiring improvement
		1.3	Compare possible strategies, techniques and tools against organisation needs
		1.4	Select possible strategies, techniques and tools
		1.5	Consult with key stakeholders to confirm selected strategies, techniques and tools
2	Develop competitive systems and practices strategies	2.1	Estimate benefit/cost ratio for major stakeholders and the value stream overall
		2.2	Determine preferred operations strategy
		2.3	Examine and adapt strategy to organisation needs and priorities
		2.4	Examine and adapt competitive systems and practices techniques and tools required to implement strategy
		2.5	Negotiate with key stakeholders to develop an implementation plan
		2.6	Determine key information and performance indicators required

3	Implement strategy	3.1	Determine data collection required
		3.2	Identify and evaluate methods of collecting and processing required data
		3.3	Determine hardware and other resources required
		3.4	Evaluate skill needs required
		3.5	Ensure all resources/training are available and completed
		3.6	Implement strategy
4	Monitor implementation of strategy	4.1	Compare information/performance indicators with desired levels
		4.2	Liaise with key stakeholders regarding strategy issues
		4.3	Identify areas requiring adjustment
		4.4	Make required adjustments

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- analysing current state/situation of the organisation and value stream, including appropriateness of strategy, operations and internal and external relationships, including value stream members
- determining appropriate key performance indicators (KPIs) and overseeing data collection
- selecting appropriate competitive systems and practices tools and techniques, such as:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping

- establishing customer pull
- kaizen and kaizen blitz
- setting of KPIs/metrics
- identification and elimination of waste
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- prioritising situations and actions based on:
  - customer benefit
  - cost/benefit analysis
- reviewing and modifying strategies and KPIs, as required

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles and tools, including:
  - value stream mapping
  - 5S
  - JIT
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators/metrics
  - identification and elimination of waste
- methods of estimating costs/benefits
- acceptable benefit/cost ratios
- continuous improvement principles
- principles of motivation and leadership
- characteristics and strengths of different types of strategies, techniques and tools, such as 5S, JIT, six sigma, lean operations and agile operations
- business goals sufficient to match the strategy to the business needs
- strategic thinking
- principles of process equipment and how to improve its reliability
- resources required and how to obtain them

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• determine appropriate analytical techniques</li> <li>• develop strategies that deliver the greatest overall benefit</li> <li>• implement the strategies</li> <li>• monitor the implementation of the strategy.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to</p>

	accommodate ethnicity, age, gender, demographics and disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> </ul>
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	<ul style="list-style-type: none"> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Competitive systems and practices techniques and tools</b>	<p>Competitive systems and practices techniques and tools may include:</p> <ul style="list-style-type: none"> <li>• value stream mapping</li> <li>• 5S</li> <li>• JIT</li> <li>• mistake proofing</li> <li>• process mapping</li> <li>• establishing customer pull</li> <li>• kaizen and kaizen blitz</li> <li>• setting of KPIs/metrics</li> <li>• identification and elimination of waste (muda)</li> <li>• standardisation</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS405002A Analyse and map a value stream

### Modification History

New unit, superseding MSACMS601A Analyse and map a value chain\* - Not equivalent

\* Prerequisite *MSACMT631A Undertake value analysis of product costs in terms of customer requirements* - removed

### Unit Descriptor

This unit of competency covers the skills and knowledge required to analyse and map a value stream, including the clear identification of the place of an organisation in the value stream and its contribution to the value stream. The unit includes the identification of an organisation in a value stream, their relationships and the activities undertaken by value stream organisations. The identification skills include identification at the virtual or information level, the technical or process level, and at the physical or logistic level.

The unit includes the analysis of value-adding and non-value adding activities and the information needs for successful value stream mapping, including information technology (IT) needs.

This unit covers the analysis of the supply chain, the demand chain as well as the overall value stream.

### Application of the Unit

This unit applies to a person in a senior role in an organisation, such as an operations manager, purchasing manager, senior technical officer performing planning or scheduling or similar who needs to analyse and map a value stream, a supply chain, or a demand chain in order to understand the interactions between all members and determine the value added/potential value added by each member. The value stream is represented visually according to organisation format requirements.

This information is the basis for the design of Just in Time (JIT) and for the determination of waste. Value stream analysis is not a one-off activity but rather an ongoing activity of re-analysis as the value stream changes and its members progress towards excellence in competitive systems and practices.

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Map the value stream	1.1	Select a product/product group for analysis
		1.2	Identify ultimate customer
		1.3	Identify ultimate supplier
		1.4	Identify all organisations between ultimate supplier and ultimate customer
		1.5	Identify all steps in own organisation
		1.6	Map value stream
2	Define customer need	2.1	Determine the features/benefits obtained by customers from product
		2.2	Determine methods of measuring the contribution to each features/benefits
		2.3	Identify possible data sources for required measures
		2.4	Implement measurement of contribution to features/benefits

- |   |                                     |     |  |
|---|-------------------------------------|-----|--|
| 3 | Assess the value added at each step | 3.1 | Identify value contributed by each external organisation                               |
|   |                                     | 3.2 | Determine value added by each internal step  |
|   |                                     | 3.3 | Determine method of measuring value added  |
| 4 | Reduce waste                        | 4.1 | Compare value added to customer benefit/feature  |
|   |                                     | 4.2 | Identify activities on value stream map which do not add to customer benefit/features  |
|   |                                     | 4.3 | Liaise with external value stream members to determine methods to reduce overall waste |
|   |                                     | 4.4 | Take required actions to reduce waste  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying for an individual organisation its place in the value stream, including immediate upstream and downstream organisations
- determining flow of materials and information along the value stream, including:
  - output quantities and qualities
  - variability in quality and quantity
  - uptime
  - other key performance indicators (KPIs) indicators appropriate to the organisation and customer requirements
- classifying steps and processes into value adding and non-value adding, including determining appropriate methods for measuring value added
- mapping value stream showing flow of information and materials in either hard copy or using software
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy

## Required knowledge

Required knowledge includes:

- purpose of value stream analysis
- methods of value stream analysis and mapping
- concept of waste and value in terms of customer benefit
- types of waste and methods of reducing it
- processes, and operations used in own organisation to make products or deliver services to internal and external customers
- processes employed by other members of the value stream sufficient to have meaningful dialogue with them

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• review activities of organisations to determine:<ul style="list-style-type: none"><li>• their place in value stream</li><li>• value added by each organisation</li><li>• non-value added steps within each organisation</li></ul></li><li>• determine methods of measuring value added</li><li>• prepare a map of a value stream that includes all value creating and non value adding steps.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li><li>• documentation and information in relation to production, waste, overheads and hazard control/management</li><li>• reports from supervisors/managers</li></ul>

	<ul style="list-style-type: none"> <li>case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>demonstration in the workplace</li> <li>workplace projects</li> <li>suitable simulation</li> <li>case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>lean operations</li> <li>agile operations</li> <li>preventative and predictive maintenance approaches</li> <li>monitoring and data gathering systems, such as</li> </ul>
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	<p>Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</p> <ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> </ul>



	<ul style="list-style-type: none"> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>
<b>Value-added</b>	<p>Value-added is measured against its contribution to the customer benefits/features and may be in the form of:</p> <ul style="list-style-type: none"> <li>• technical benefits/features</li> <li>• location benefits/features</li> <li>• aesthetic benefits/features</li> <li>• information benefits/features</li> </ul>
<b>Map value stream</b>	<p>The map of the value stream can be completed using:</p> <ul style="list-style-type: none"> <li>• hard copy (e.g. paper or whiteboard)</li> <li>• appropriate software tools</li> </ul> <p>The map should show all participants and stages of materials and information flow and the value creating and non-value adding steps and processes</p>
<b>JIT</b>	<p>JIT refers to:</p> <ul style="list-style-type: none"> <li>• a production scheduling concept that calls for any item needed at a production operation (whether raw material, finished item, or anything in between) to be produced and available precisely when needed, neither a moment earlier nor a moment later</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product. Within operations, categories of waste include:</p> <ul style="list-style-type: none"> <li>• excess production and early production</li> <li>• delays</li> <li>• movement and transport</li> <li>• poor process design</li> <li>• inventory</li> <li>• inefficient performance of a process</li> <li>• making defective items</li> <li>• activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405003A Manage a value stream**

### **Modification History**

New unit, superseding MSACMS602A Manage a value chain\* - Not equivalent

\* Prerequisites MSACMS601A Analyse and map a value chain and MSACMT631A Undertake value analysis of product costs in terms of customer requirements - removed

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to manage a value stream, a supply chain or a demand chain, including close liaison with suppliers and customers.

This unit covers the managing of the supply chain, the demand chain as well as the overall value stream and may be applied to the managing of the chain internally/externally within an organisation.

### **Application of the Unit**

This unit applies to a person in a senior role in an organisation, such as a manager, technical specialist or similar, who needs to manage the value/supply/demand chain on an ongoing basis to achieve the best overall contribution of value added to their product in terms of customer benefit/features. The unit can be applied to value streams of large or small organisations and to internal and external value streams or a combination value stream.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Evaluate the value stream	1.1	Identify all members in the value stream for products in area of responsibility
		1.2	Identify value added by each member of the chain
		1.3	Identify non-value adding steps in the value stream
		1.4	Identify acute and chronic issues which impact on the value stream
		1.5	Develop priority list of items for improvement
2	Liaise regularly with chain members	2.1	Establish and maintain regular liaison with all chain members
		2.2	Identify current and forecast issues with each member
		2.3	Work with members to help them address their issues
		2.4	Build trust and confidence in the relationship
		2.5	Develop with each chain member a priority list of items for improvement
		2.6	Negotiate with all chain members to ensure improvements benefit chain members and improve the benefits/features perceived by the ultimate customer
3	Monitor the value added at each step	3.1	Identify changes in value added by each chain member
		3.2	Identify areas where changes to value added are required

- |   |                          |   |
|---|--------------------------|---|
|   | 3.3                      | Develop a priority list of required value-added changes           |
|   | 3.4                      | Work with chain member to bring about improvements to value added |
| 4 | Continue to reduce waste |   |
|   | 4.1                      | Identify waste in value stream                                    |
|   | 4.2                      | Work with chain members to continually reduce waste               |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reading and interpreting a value stream map
- identifying, monitoring and managing flow of materials, information and services in the value stream, including:
  - output quantities and qualities
  - variability
  - uptime
  - other key performance indicators (KPIs) indicators appropriate to the value stream organisations and customer benefit/requirements
- communicating and negotiating at all levels in the organisation and value stream and with individuals of different levels of literacy and numeracy
- identifying steps and processes as value adding and non-value adding
- using appropriate methods for measure value added at steps in the value stream

### Required knowledge

Required knowledge includes:

- purpose of value stream analysis
- methods of value stream analysis and mapping
- concept of waste and value in terms of customer benefit
- types of waste and methods of reducing it
- processes, and operations used in own organisation to make products or deliver services to internal and external customers

- processes employed by other members of the value stream sufficient to have meaningful dialogue with them

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• review activities of organisations to determine:</li> <li>• their place in value stream</li> <li>• value added by each organisation</li> <li>• non-value added steps within each organisation</li> <li>• determine priorities for improvement in own organisation</li> <li>• negotiate with value stream members on improvements</li> <li>• monitor improvements to determine value added.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> </ul>

	<ul style="list-style-type: none"> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> </ul>
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	<ul style="list-style-type: none"> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>
<b>Value added</b>	<p>Value added is measured against its contribution to the customer benefits/features and may be in the form of:</p> <ul style="list-style-type: none"> <li>• technical benefits/features</li> <li>• location benefits/features</li> <li>• aesthetic benefits/features</li> </ul>



	<ul style="list-style-type: none"><li>• information benefits/features</li></ul>
<b>Value stream map</b>	<p>The map of the value stream may include:</p> <ul style="list-style-type: none"><li>• hard copy (e.g. paper or whiteboard)</li><li>• using appropriate software</li></ul> <p>The map should show all participants and stages of materials and information flow and the value creating and non-value adding steps and processes</p>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product. Within operations, categories of waste include:</p> <ul style="list-style-type: none"><li>• excess production and early production</li><li>• delays</li><li>• movement and transport</li><li>• poor process design</li><li>• inventory</li><li>• inefficient performance of a process</li><li>• making defective items</li><li>• activities which do not yield any benefit to the organisation or any benefit to the organisation's customers</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405004A Develop business plans in an organisation implementing competitive systems and practices**

### **Modification History**

New unit, superseding MSACMS603A Develop manufacturing related business plans - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop business plans in an organisation implementing competitive systems and practices.

### **Application of the Unit**

This unit applies to a person in an organisation implementing competitive systems and practices (e.g. a production/plant manager, purchasing/technical officer or similar) who is required to develop a section business plan to meet the requirements of the overall strategic plan of the organisation. The plan includes the impact on the value stream and other critical competitive systems and practices factors. Due to competitive pressures this may be a reasonably frequent activity and can occur at any time over the business cycle. The plan may be in response to a specific change, or it may be a plan for the next period.

This unit assumes that up-to-date information about the organisation's role in the value stream is available. For detailed mapping and analysis of the value stream refer to MSS405002A Analyse and map a value stream.

This unit primarily requires the application of skills associated with gathering, analysing and applying information and consulting with stakeholders. Problem solving, initiative and enterprise, and planning and organising are required to develop an effective and measurable business plan. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into competitive systems and practices strategies.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Determine purpose of plan	1.1	Confirm reason for developing plan and expected outcomes from plan
		1.2	Confirm purpose of plan with all relevant stakeholders
		1.3	Check expected outcomes from plan with overall strategic plan for organisation
		1.4	Identify any potential areas for conflict between proposed plan and strategic directions
		1.5	Negotiate with relevant stakeholders to resolve issues
2	Develop objectives and strategies	2.1	Draft objectives for business plan
		2.2	Draft strategies to achieve these objectives
		2.3	Determine implications for value stream
		2.4	Determine capital or workplace layout/organisation implications for objectives and strategies
3	Develop plans to meet objectives	3.1	Negotiate with relevant stakeholders over implications for objectives and strategies

	and strategies	3.2	In liaison with relevant stakeholders, develop plans to meet objectives
		3.3	Determine relevant key performance indicators (KPIs) for plan
		3.4	Check KPIs are appropriate for purpose of plan
		3.5	Check plan will deliver planned purpose
		3.6	Map plan to changed value stream
		3.7	Adjust plan to optimise value stream
		3.8	Validate plan with relevant stakeholders
4	Monitor the implementation of the plan	4.1	Release plan for implementation
		4.2	Check the key progress points against the key stages of the plan
		4.3	Note any discrepancies
		4.4	Take appropriate action to ensure correct implementation of plan

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- analysing organisation overall strategic plan for implications relevant to competitive systems and practices implementation
- determining appropriate KPIs and methods of data collection
- determining best means of gathering data, including data from monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary

systems

- identifying value stream members and performance
- determining implications of business plan for value stream
- analysing data, including competitive systems and practices indicators and verifying results with stakeholders
- determining key parameters for business plan, including:
  - scope
  - period
  - objectives in terms of customer benefit
  - relationship to overall organisation objectives
  - targets
  - KPIs
  - implementation strategy
  - risk management
  - monitoring and adjustment strategy
  - approval process

## Required knowledge

Required knowledge includes:

- organisation strategic directions
- business planning methods and types of plans
- contingency planning and other risk mitigating planning tools
- the organisation's value stream
- analysis of value stream
- competitive systems and practices
- application of quality principles
- human resources and industrial relations
- occupational health and safety (OHS)

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• develop a business plan that conforms to organisation</li></ul>
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	<p>overall strategic directions</p> <ul style="list-style-type: none"> <li>• determine implications of business plan for competitive systems and practices practice in organisation</li> <li>• determine KPIs appropriate for business plan</li> <li>• monitor the implementation of a business plan and make adjustments as necessary.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as SCADA software, ERP systems, MRP and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p>
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	<ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Plan</b>	<p>Plan may include:</p> <ul style="list-style-type: none"> <li>any sort of business plan and may emphasise any of the areas for sub-plans over the others</li> </ul>
<b>Objectives</b>	<p>Objectives may include performance in terms of:</p> <ul style="list-style-type: none"> <li>sales</li> <li>profit</li> <li>quality</li> <li>OHS</li> <li>environment</li> <li>competitive systems and practices</li> <li>human, physical, financial and environmental/resource use</li> </ul>
<b>Objectives and strategies</b>	<p>Objectives and strategies may include:</p> <ul style="list-style-type: none"> <li>human and industrial relations practice</li> <li>material/component and resources use</li> <li>sustainable environmental practices</li> <li>sales and marketing</li> <li>financial</li> <li>regulatory compliance</li> </ul>
<b>Relevant stakeholders</b>	<p>Relevant stakeholders may include:</p> <ul style="list-style-type: none"> <li>other team members</li> <li>other workers</li> <li>management</li> <li>technical specialists</li> <li>other members of the value stream</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value adding and non value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>sales outlet/representative</li> <li>information gathering, data analysis and research</li> <li>product design</li> </ul>



	<ul style="list-style-type: none"><li>• raw material sourcing</li><li>• intermediate processing</li><li>• final assembler/ collation/preparation</li><li>• support services (e.g. accounting, finance and legal)</li><li>• storage and delivery to customer</li><li>• after market support</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405005A Manage competitive systems and practices responding to individual and unique customer orders**

### **Modification History**

New unit, superseding MSACMS604A Manage competitive manufacturing processes in a jobbing shop environment\* - Not equivalent

\* Prerequisites *MSACMS601A Analyse and map a value chain, MSACMT280A Undertake root cause analysis, MSACMT631A Undertake value analysis of product costs in terms of customer requirements* - removed

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to prepare for and manage the introduction of competitive systems and practices processes in an organisation that does not undertake repetitive processes or mass produce products and instead responds to individual and unique customer orders.

### **Application of the Unit**

This unit applies to the introduction of competitive systems and practices processes in an environment where the organisation or part of the organisation specialises in one-off or small batch product or operations driven by individual and unique customer orders (e.g. overhaul of equipment, jobbing manufacture, supply of customised/bespoke services or product).

This unit describes the skills needed to restructure the process and work organisation to allow the application of competitive systems and practices tools and techniques.

This unit requires the application of skills associated with problem solving, initiative, enterprise, planning and organising in order to manage competitive systems and practices processes in a jobbing shop environment. This unit also requires communication and teamwork skills to gather information about processes and implement redesign plans.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse the existing operations	1.1	Identify organisation capability for products and processes
		1.2	Identify the major processing steps in meeting customer order or orders
		1.3	Consult with employees, managers and other major stakeholders on major expected benefits from a move to a competitive systems and practices strategy
		1.4	Identify lead times, throughput times and waiting times throughout process of meeting a customer order
		1.5	Identify variations within the process
		1.6	Identify causes of the variations
2	Draft a virtual flow process	2.1	Consider similarities in materials, processes and services for orders
		2.2	Map flow of information, material, processes and people for each product family/cluster of similar customised products/services
		2.3	Draw a current state value stream map for the process as a virtual flow process

- 2.4 Analyse the current value stream map for waste
  - 2.5 Draft possible future state value stream map
  - 2.6 Calculate benefits flowing from future state map
  - 2.7 Consult with stakeholders to validate benefits
- 3 Prepare proposals for process redesign
  - 3.1 Identify options for the delivery of competitive systems and practices and other changes required to move to future state value stream map
  - 3.2 Plan as to how these changes might be implemented
  - 3.3 Cost the proposed changes and determine benefit/cost ratios
  - 3.4 Prepare recommendations for change
  - 3.5 Negotiate/consult with relevant stakeholders to establish the preferred option
- 4 Implement the plan
  - 4.1 Arrange for altered process, as required
  - 4.2 Arrange for altered infrastructure needs, as required
  - 4.3 Monitor the implementation of the plan, making adjustments as required
  - 4.4 Review the new value stream and check that expected benefits have been obtained
  - 4.5 Put in place a continuous improvement mechanism for the new value stream

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and draw current state maps for jobs/processes
- analysing current targets for jobs (e.g. quality, time and cost) and identifying variations from targets
- analysing current processes used in the organisation, including appropriateness of strategy, operations, and internal and external relationships, including value stream members
- identifying waste
- proposing changes and determine cost/benefit of each change
- selecting and adapting appropriate competitive systems and practices tools and techniques for a jobbing environment, such as:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - kaizen and kaizen blitz
  - setting of key performance indicators(KPIs)/metrics
  - identification and elimination of waste
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- developing future state maps

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles and tools, including:
  - value stream mapping
  - 5S
  - JIT
  - mistake proofing
  - process mapping
  - kaizen and kaizen blitz
  - setting of KPIs/metrics
  - identification and elimination of waste
  - establishing customer pull
  - standardisation
- processes used in jobbing manufacture and other non-repetitive operations businesses
- capabilities of equipment
- methods of estimating costs/benefits
- acceptable benefit/cost ratios
- continuous improvement principles

- abilities and skills of personnel in organisation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• analyse existing operations and draft virtual flow process</li> <li>• determine improvements that deliver the greatest overall benefit</li> <li>• plan the implementation of competitive systems and practices strategy, techniques and tools</li> <li>• produce a current state value stream map</li> <li>• draft possible future state value stream map</li> <li>• monitor a continuous improvement strategy.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<p><b>Method of assessment</b></p>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> </ul>

	<ul style="list-style-type: none"> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and</li> </ul>
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	<p>analysis</p> <ul style="list-style-type: none"> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Variations</b>	<p>Variations are deviations from desired targets and may cover variations in:</p> <ul style="list-style-type: none"> <li>• quality</li> <li>• time</li> <li>• cost</li> <li>• occupational health and safety (OHS)</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit or features in the product. Within operations, categories of waste include:</p> <ul style="list-style-type: none"> <li>• excess production and early production</li> <li>• delays</li> <li>• movement and transport</li> <li>• poor process design</li> <li>• inventory</li> <li>• inefficient performance of a process</li> <li>• making defective items</li> <li>• activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• managers</li> </ul>



	<ul style="list-style-type: none"> <li>• supervisors</li> <li>• employees</li> <li>• shareholders</li> <li>• OHS mechanisms/representatives</li> <li>• Industrial relations mechanisms/representatives</li> <li>• suppliers</li> <li>• customers</li> <li>• service providers</li> </ul>
<b>Infrastructure needs</b>	<p>Infrastructure needs may include:</p> <ul style="list-style-type: none"> <li>• physical infrastructure, including plant, equipment, tools, systems and processes</li> <li>• information and control infrastructure</li> <li>• work organisation, including numbers of employees</li> <li>• work structure and skills and knowledge held by employees</li> <li>• workforce development and, where required, training</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value adding and non value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/ collation/preparation</li> <li>• support (services e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405007A Introduce competitive systems and practices to a small or medium enterprise**

### **Modification History**

New unit, superseding MSACMS606A Introduce competitive manufacturing to a small or medium enterprise - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to introduce competitive systems and practices into a small or medium operations enterprise (SME)

### **Application of the Unit**

This unit applies to the introduction of competitive systems and practices into a SME. The unit may also apply to any small or medium not-for-profit organisation seeking to improve their processes through competitive systems and practices. The unit covers any constraints that may be placed on how competitive systems and practices are introduced and which aspects of competitive systems and practices are introduced due to the limitations of being a SME.

This unit requires the application of skills associated with problem solving, initiative, enterprise, planning and organising in order to determine competitive systems and practices processes appropriate for a small business environment. This unit also requires communication and analysis skills to gather information about processes and implement competitive systems and practices strategies.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Analyse the current operations systems and processes   | 1.1 | Review the reasons for introducing competitive systems and practices and confirm the expected benefits with relevant stakeholders      |
|   |  | 1.2 | Determine any internal limiting factors which will constrain the introduction of competitive systems and practices                     |
|   |  | 1.3 | Determine any external limiting factors which will constrain the introduction of competitive systems and practices                     |
|   |  | 1.4 | Quantify expected returns from achieving the benefits of introducing competitive systems and practices                                 |
|   |  |     |  |
| 2 | Develop strategic and tactical plans to introduce competitive systems and practices to the SME | 2.1 | Develop a strategic plan for the SME that takes into account the nature of its business and relationships with suppliers and customers |
|   |  | 2.2 | Where required, seek authority for the implementation of the strategic plan  |
|   |  | 2.3 | Identify components of competitive strategy which will yield quick returns   |
|   |  | 2.4 | Identify actions which will free up required resources to allow for the introduction of competitive systems and practices              |
|   |  | 2.5 | Develop achievable tactical plans which are compatible with strategy   |
|   |  | 2.6 | Develop key performance indicators (KPIs) for strategic  |

		and tactical plans								
	2.7	Consult with relevant stakeholders to confirm tactical plans								
	2.8	Prioritise plans for order of implementation								
3	Implement competitive systems and practices	<table><tr><td>3.1</td><td>Implement priority tactical plan</td></tr><tr><td>3.2</td><td>Determine benefits from change</td></tr><tr><td>3.3</td><td>Use benefits from priority plan to assist in the implementation of further tactical plans</td></tr><tr><td>3.4</td><td>Review progress towards strategic objectives and adjust plans, as appropriate, in consultation with relevant stakeholders</td></tr></table>	3.1	Implement priority tactical plan	3.2	Determine benefits from change	3.3	Use benefits from priority plan to assist in the implementation of further tactical plans	3.4	Review progress towards strategic objectives and adjust plans, as appropriate, in consultation with relevant stakeholders
3.1	Implement priority tactical plan									
3.2	Determine benefits from change									
3.3	Use benefits from priority plan to assist in the implementation of further tactical plans									
3.4	Review progress towards strategic objectives and adjust plans, as appropriate, in consultation with relevant stakeholders									

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing current processes used in the SME, including appropriateness of strategy, operations, and internal and external relationships, including value stream members
- distinguishing between and prepare strategic and tactical plans
- selecting and adapting appropriate competitive systems and practices and techniques for an SME environment, such as:
  - value stream mapping
  - 5S
  - Just in Time
  - mistake proofing
  - process mapping
  - kaizen and kaizen blitz
  - setting of KPIs/metrics
  - identification and elimination of waste
- developing KPIs appropriate for an SME
- communicating to individuals with different levels of literacy and numeracy
- monitoring implementation and establishing continuous improvement

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles and tools, including:
  - value stream mapping
  - 5S
  - JIT
  - mistake proofing
  - process mapping
  - kaizen and kaizen blitz
  - setting of KPIs/metrics
  - identification and elimination of waste
  - establishing customer pull
  - standardisation
  - quick changeovers
- continuous improvement principles
- principles for deciding acceptable benefit/cost ratios in a SME

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	Evidence of the ability to organise implementation of competitive systems and practices in a SME should be available.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• analyse existing SME operations</li><li>• determine competitive systems and practices key performance indicators for a SME organisation</li><li>• determine improvements that deliver the greatest overall benefit</li><li>• develop and supervise the implementation of competitive systems and practices strategy, techniques and tools in a SME.</li></ul>

<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li><li>• documentation and information in relation to production, waste, overheads and hazard control/management</li><li>• reports from supervisors/managers</li><li>• case studies and scenarios to assess responses to contingencies.</li></ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"><li>• demonstration in the workplace</li><li>• workplace projects</li><li>• suitable simulation</li><li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li><li>• targeted questioning</li><li>• reports from supervisors, peers and colleagues (third-party reports)</li><li>• portfolio of evidence.</li></ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p>



	<ul style="list-style-type: none"> <li>• managers</li> <li>• supervisors</li> <li>• employees and their representatives</li> <li>• shareholders</li> <li>• suppliers</li> <li>• customers</li> <li>• service providers</li> </ul>
<b>Internal limiting factors</b>	<p>Internal limiting factors may include:</p> <ul style="list-style-type: none"> <li>• free cash</li> <li>• management time and expertise</li> <li>• machinery</li> <li>• work organisation and workforce skills and knowledge</li> </ul>
<b>External limiting factors</b>	<p>External limiting factors may include lack of bargaining power or effective communication with:</p> <ul style="list-style-type: none"> <li>• suppliers</li> <li>• customers</li> <li>• financial institutions</li> <li>• other factors</li> </ul>
<b>Expected returns</b>	<p>Expected returns may include factors such as:</p> <ul style="list-style-type: none"> <li>• cost savings due to more consistent or higher quality</li> <li>• benefits from greater on-time delivery</li> <li>• savings from lower inventories and reduction in waste</li> </ul>
<b>Actions which will free up required resources</b>	<p>Actions which will free up required resources will vary according to the size of the SME and the nature of the operations undertake. Examples include:</p> <ul style="list-style-type: none"> <li>• reduction of inventory</li> <li>• reduction of scrap</li> <li>• decreased throughput times</li> <li>• changes in approval processes/delegations</li> <li>• use of computers instead of paper-based processes</li> </ul>
<b>Prioritise plans</b>	<p>Prioritise plans according to criteria such as:</p> <ul style="list-style-type: none"> <li>• greatest benefit</li> <li>• ease of implementation</li> <li>• best fit with strategy</li> <li>• available resources</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405010A Manage relationships with non-customer external organisations**

### **Modification History**

New unit, superseding MSACMS606A Manage relationships with non-customer external organisations - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to identify and manage relationships with non-customer external organisations, such as community groups, other businesses, training providers, research organisations and government departments.

### **Application of the Unit**

This unit applies to a person who has policy responsibility in an organisation for managing external relationships that may impact on the performance, community standing or regulatory compliance of the organisation. Examples of the application of this unit include department leaders, managers or similar. The unit covers managing a range of external organisations to the maximum benefit of the organisation and the organisation's customers while also identifying areas of mutual interest and benefit with the external organisations. Relationships may or may not be initiated by the person's own organisation.

This unit does not cover the analysis and improvement of relationships between members of a value stream, such as suppliers and customers.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Problem solving, initiative and enterprise, and planning and organising are also required. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into relationship systems and expectations.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify mutual interest	1.1	Clarify the reason contact was/is to be made for each relevant external organisation
		1.2	Gather information on extent of past contact and any positive or negative outcomes for own and external organisation
		1.3	Identify expectations of initiating organisation
		1.4	Analyse the breadth, depth and complexity of external organisations' expectations
		1.5	Discuss expectations, ability to meet those expectations, and areas of mutual interest with relevant internal and external representatives
2	Determine contribution of relationship	2.1	Identify any value contributions from relationship
		2.2	Identify waste arising from relationship
		2.3	Classify waste as necessary or unnecessary
		2.4	Set key performance indicators (KPIs) for future relationship
3	Manage the	3.1	Measure current performance of relationship against

relationship	expectations and KPIs
3.2	Develop systems to enhance mutual benefit and value contributions from relationship
3.3	Develop systems to minimise and control necessary waste without causing harm
3.4	Eliminate unnecessary waste, where possible, without causing harm
3.5	Monitor KPIs and determine future strategy for the relationship
3.6	Continue to manage terminate the relationship in a manner which enhances the organisation

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using formal problem solving procedures, such as root cause analysis (RCA)
- analysing contributions to value from external relationships
- identifying waste (muda)
- developing formal and informal communication procedures with other individuals and organisations
- establishing sources of assistance in own organisation for external individuals and organisations
- interpreting documents, procedures and instructions for others
- establishing KPIs for relationships

### Required knowledge

Required knowledge includes:

- strategic requirements of own organisation
- strategic benefits to the organisation from liaisons with external organisations
- possible external organisations which may offer benefits
- benefits which can be offered to the external organisations
- customer benefits/features from products and processes of own organisation

- waste (muda) elimination
- formal problem solving procedures (e.g. RCA)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse the value and waste in relationships</li> <li>• implement changes to relationships to improve outcomes for their organisation and its customers</li> <li>• monitor outcomes of a relationship against KPIs</li> <li>• communicate complex information to external representatives using a variety of methods and mediums.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace that is engaging with one or more non-customer external organisations.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• historical information on the relationship with external organisation and the involvement of the assessee</li> <li>• workplace procedures and plans</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to relationships with non-customer external organisations</li> <li>• reports from supervisors/managers on interaction with external non-customer organisations</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> </ul>

	<ul style="list-style-type: none"> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and</li> </ul>
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	<p>analysis</p> <ul style="list-style-type: none"> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Reasons for contact</b>	<p>Reasons for contact may include:</p> <ul style="list-style-type: none"> <li>• research</li> <li>• innovation</li> <li>• mutual cooperation</li> <li>• strategic alliances</li> <li>• computer (or other) technology</li> <li>• emergency response</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product. Categories of waste include:</p> <ul style="list-style-type: none"> <li>• excess production and early production</li> <li>• delays</li> <li>• movement and transport</li> <li>• poor process design</li> <li>• inventory</li> <li>• inefficient performance of a process</li> <li>• making defective items</li> <li>• activities which do not yield any benefit to the organisation or any benefit to the organisation's customers</li> </ul>



<b>Necessary waste</b>	<p>Necessary waste includes:</p> <ul style="list-style-type: none"> <li>any activity or cost which does not contribute directly to customer benefit/feature in the product, and which cannot be avoided (e.g. regulatory compliance and fixed costs)</li> </ul> <p>Necessary waste cannot be eliminated but should be managed</p>
<b>Unnecessary waste</b>	<p>Unnecessary waste includes:</p> <ul style="list-style-type: none"> <li>any activity or cost which does not contribute directly to customer benefit/features in the product and can be avoided</li> </ul> <p>Unnecessary waste should be eliminated as quickly as practical</p>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405011A Manage people relationships**

### **Modification History**

New unit, superseding MSACMC611A Manage people relationships - Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to manage the human relationship aspects of implementing and operating competitive systems and practices.

### **Application of the Unit**

This unit applies to a person (who may be a manager, technical specialist or other person) who is required to work with employees and relevant people, encourage them to accept change and also to increase the quality, quantity and reliability of output consistent with customer requirements.

This unit primarily requires strong communication, teamwork and problem solving skills to achieve effective relationships that support a competitive systems and practices environment. Initiative, enterprise, planning and organising are also required to ensure relationships are monitored and issues are resolved proactively. The unit also includes aspects of self-management and learning to ensure improvement of own performance and communication skills.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Confirm organisation competitive systems and practices status	1.1	Establish number and status of competitive systems and practices techniques being used within the organisation
		1.2	Identify key performance indicators (KPIs) for each technique
		1.3	Identify key sections and value stream members responsible for each KPI
		1.4	Identify key personnel for communications
2	Develop an open environment	2.1	Establish and maintain regular dialogue between all levels and all relevant sections of the organisation
		2.2	Encourage a flow of communications in both directions
		2.3	Develop and maintain a formal mechanism for the flow of issues, concerns and suggestions in both directions
		2.4	Develop and maintain regular and frequent communication with all key stakeholders
3	Identify significant issues	3.1	In liaison with relevant team members/stakeholders, identify current and potential issues
		3.2	Assist team members/stakeholders to formulate issues
		3.3	Identify and define boundary and non-negotiable issues for all team members/stakeholders
		3.4	Negotiate with relevant team members/stakeholders over actual and potential issues

- |   |                            |     |  |
|---|----------------------------|-----|--|
| 4 | Proactively resolve issues | 4.1 | Liaise with team members/stakeholders to develop agreed, and where possible, win-win solutions |
|   |                            | 4.2 | Negotiate acceptable solutions, as required, in accordance with company practices/procedures   |
|   |                            | 4.3 | Obtain any required official authorisations  |
|   |                            | 4.4 | Consult with relevant stakeholders to develop implementation plan                              |
|   |                            | 4.5 | Implement solution   |
|   |                            |     |  |
| 5 | Monitor ongoing situation  | 5.1 | Determine relevant KPIs for plan   |
|   |                            | 5.2 | Check that implementation is proceeding to plan  |
|   |                            | 5.3 | Check for unforeseen consequences  |
|   |                            | 5.4 | Take appropriate action to resolve any arising issues  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing the competitive operational techniques being implemented in the organisation and the stage of implementation, including identifying people, related needs and issues
- using formal problem solving procedures, such as root cause analysis (RCA)
- analysing work procedures
- developing formal and informal communication procedures with others in work area, team leaders and other employees relevant to competitive systems and practices changes
- establishing sources of assistance in the organisation for people experiencing difficulty with competitive systems and practices changes
- interpreting procedures and instructions relevant to own expertise for others
- establishing KPIs for own work

### Required knowledge

Required knowledge includes:

- features and benefits of common competitive operational practices, including:
  - Just in Time (JIT) and kanban systems
  - preventative maintenance
  - 5S housekeeping
  - continuous improvement processes (kaizen)
  - waste (muda) elimination
  - formal problem solving procedures (e.g. RCA)
  - standardised work
- health, safety and environment (HSE) principles and requirements for organisation
- change implementation contacts and procedures for the organisation
- employee assistance mechanisms in the organisation
- current processes and principles of operation sufficient to enable communication with others on the impact of competitive operational changes
- sources of data on the process/plant and possible applications to information distribution
- methods of determining own skill needs and developing skills, if required

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- identify the processes used and scope of products/ services supplied by the organisation and the deliverables expected by customers
- relate processes and products/services to the competitive systems and practices implementation process and the stage of implementation
- communicate and gain support for changes made as a result of the implementation of the competitive systems and practices implementation
- develop formal and informal channels of communication, including feedback mechanisms
- proactively resolve issues and problems raised by people with the competitive systems and practices implementation process.

### Context of and specific resources

Assessment of performance must be undertaken in a

<b>for assessment</b>	<p>workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Key personnel</b>	<p>Key personnel for communication include:</p>

	<ul style="list-style-type: none"><li>formally identified managers, supervisors and workforce delegates as well as key opinion shapers (e.g. employees with specialist technical knowledge) on the issue being communicated</li></ul>
<b>Formal mechanisms</b>	<p>Formal mechanisms for communication will vary according to the organisation but may include:</p> <ul style="list-style-type: none"><li>noticeboards</li><li>employee circulars</li><li>consultative committees</li><li>staff associations</li><li>union representatives</li><li>team leaders</li></ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"><li>team members</li><li>personnel officers</li><li>industrial officers</li><li>union delegates</li><li>production management</li><li>human relations management</li><li>financial management</li><li>engineering/technical personnel</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.



## **MSS405012A Manage workplace learning**

### **Modification History**

New unit, superseding MSACMC612A Manage workplace learning - Not equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to manage the learning and skill development for employees within an organisation implementing competitive systems and practices.

### **Application of the Unit**

This unit applies to a person responsible for management of the identification of skills needed by employees to undertake required work in implementing competitive systems and practices, including arranging for any required learning processes. The unit does not cover trainer and assessor skills.

This unit primarily requires the application of skills associated with communication, teamwork, problem solving, initiative and enterprise in order to assess and address skill needs in an individual and in the organisation. Planning and organising is required to ensure skill development meets the needs of the organisation and aspects of self-management and learning are required to ensure improvement of performance.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine current skill requirements for employees	1.1	Establish range and stage of implementation of competitive systems and practices techniques in the organisation
		1.2	Consult with relevant stakeholders on skill requirements for effective implementation of competitive systems and practices techniques used in the organisation
		1.3	Ensure records/database of skill mix currently required by employees are maintained in accordance with procedures
		1.4	Re-assess and monitor the skills required by employees as organisation requirements change
		1.5	Consult with relevant stakeholders to predict any new/different skill requirements arising from changes to products, processes, equipment or work organisation
2	Determine current skill mix of employees	2.1	Ensure current records/database of skill profile of individuals are maintained
		2.2	Consult with relevant stakeholders and monitor the application of these skills in the workplace to ensure they remain current and valid
		2.3	Review the actual skill mix of employees compared to the required skill mix
3	Make arrangements for skill development	3.1	Consult with employees and identify any mismatch of skills possessed and used and skills required
		3.2	Identify any new skills required due to anticipated changes

- |   |                                      |     |  |
|---|--------------------------------------|-----|--|
|   |                                      | 3.3 | Consult with relevant stakeholders to determine the best way to refresh existing skills/develop new skills |
|   |                                      | 3.4 | Develop individual skill development program   |
|   |                                      | 3.5 | Ensure skill development arrangements are implemented in accordance with procedures                        |
| 4 | Forecast possible future skill needs | 4.1 | Examine strategic directions of organisation   |
|   |                                      | 4.2 | Discuss possible future directions with relevant stakeholders  |
|   |                                      | 4.3 | Determine possible long-term future skill requirements in consultation with relevant stakeholders          |
|   |                                      | 4.4 | Develop plan to ensure skills are developed in advance of when they are required                           |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing the competitive operational techniques being implemented in the organisation and the stage of implementation, including establishing skill needs to support implementation
- using formal problem solving procedures, such as root cause analysis (RCA)
- analysing work procedures
- developing formal and informal communication procedures with others in work area, team leaders and other employees relevant to competitive systems and practices changes
- establishing sources of assistance in the organisation for people experiencing difficulty with competitive systems and practices changes
- interpreting procedures and instructions relevant to own expertise for others
- establishing key performance indicators (KPIs) for own work

### Required knowledge

Required knowledge includes:

- features and benefits of common competitive operational practices, including:
  - Just in Time (JIT) and kanban systems
  - preventative maintenance
  - 5S housekeeping
  - continuous improvement processes (kaizen)
  - waste (muda) elimination
  - formal problem solving procedures (e.g. RCA)
  - standardised work
- skill analysis methods or how to access skill analysis from relevant experts
- skill development methods or how to access skill development programs from relevant experts
- electronic and other systems to record and maintain training and skills records
- formal qualifications and skill standards relevant to competitive systems and practices and the processes and products of the organisation
- current processes and principles of operation sufficient to enable communication with others on the impact of competitive operational changes
- sources of data on the processes and/or products of the organisation and implications for workplace learning
- methods of determining own skill needs and developing skills, if required

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify the processes used and scope of products/services supplied by the organisation and the deliverables expected by customers</li> <li>• relate processes and products/services to the competitive systems and practices implementation process and the stage of implementation</li> <li>• establish skill needs from processes/products and competitive implementation process in the organisation</li> <li>• use formal and informal channels of communication, including feedback mechanisms to assist in identification of skill needs</li> <li>• manage delivery and recording of training to ensure</li> </ul>
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	required skills are gained by employees.
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to past and current skill development for employees</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p>

	<ul style="list-style-type: none"> <li>• team members</li> <li>• personnel officers</li> <li>• industrial officers</li> <li>• union delegates</li> <li>• production management</li> <li>• human relations management</li> <li>• financial management</li> <li>• engineering/technical personnel</li> </ul>
<b>Skill development arrangements</b>	<p>Skill development arrangements include:</p> <ul style="list-style-type: none"> <li>• formal vocational and education delivery by a registered training provider (RTO)</li> <li>• education and training delivery by a higher education provider</li> <li>• non-accredited on and off the job training by the organisation, equipment suppliers, industry associations, and so on</li> <li>• coaching and mentoring</li> <li>• self-directed learning</li> <li>• arrangements for recording skills gained by employees</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the processes in an organisation</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. Good manufacturing practice (GMP) and responsible care)</li> <li>• government regulations</li> <li>• industrial relations requirements and any classification changes that result from the acquisition of higher level skills</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>

## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.



# MSS405020A Develop quick changeover procedures

## Modification History

New unit, superseding MSACMT620A Develop quick changeover procedures - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to develop/improve changeovers for equipment, processes or operations. It includes critically analysing existing changeovers, applying quick changeover principles, and developing improved changeover procedures.

## Application of the Unit

This unit applies to managers, technical specialists or similar in an organisation that has adopted or is adopting a quick changeover approach to its changeovers. The changeovers may be to equipment, processes or operations. This unit applies to the structured development and/or improvement of the changeover procedures.

This unit requires the application of skills associated with communication, problem solving, initiative, enterprise, planning and organising in order to analyse and determine changeover procedures. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into the development of procedures.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised

unit of competency.

text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse changeover	1.1	Critically observe changeover process
		1.2	Identify steps in changeover
		1.3	Identify start situation and required finish situation for changeover
2	Apply quick changeover principles	2.1	Identify changes to the start situation and required finish situation which are possible
		2.2	Identify internal and external changeover activities
		2.3	Identify activities which could be improved/eliminated
		2.4	Eliminate/reduce adjustments required after changeover
		2.5	Develop improved changeover process and recommendations for implementation procedure
		2.6	Liaise with relevant people to validate recommendations
3	Assess and minimise risks in changeover	3.1	Analyse hazards and risks from all steps in changeover
		3.2	Apply ergonomic principles and hierarchy of control to each equipment and manual hazard
		3.3	Assess any regulatory risk in changeover
		3.4	Minimise hazards during changeover ensuring final risk profile is acceptable
4	Implement	4.1	Acquire any required resources and approvals

improved changeover	4.2	Organise trials of improved changeover
	4.3	Monitor trial
	4.4	Make adjustments to changeover process
	4.5	Implement improved changeover process

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- critically analysing an existing changeover, including a detailed examination of all actions and delays and the times taken
- determining key steps in changeover
- identifying regulatory implications and other risks changes to procedures
- differentiating between habitual practice and necessary activity
- identifying opportunities to maximise external set up work
- communicating with others to explain and supervise changed procedures

### Required knowledge

Required knowledge includes:

- principles of quick changeover
- equipment and operating environment of activities subject to quick changeover
- regulatory and commercial obligations and risk environment for operations subject to quick changeover analysis
- safe movement and other relevant occupational health and safety (OHS) principles
- relevant procedures
- purposes/requirements of changeover
- sourcing of resources
- trialling procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• observe and analyse steps in an existing changeover</li> <li>• manage risks in adjusting changeover procedures</li> <li>• develop changeover adjustments that deliver the greatest overall benefit</li> <li>• supervise changeover procedure trials.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenario, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess</p>

	<p>underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> </ul>
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	<ul style="list-style-type: none"> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Changeover</b>	<p>Changeover may refer to:</p> <ul style="list-style-type: none"> <li>• equipment exchanges, such as an exchange of dies/tools (traditional)</li> <li>• change between batches</li> <li>• change between campaigns (process manufacturing)</li> <li>• quantum equipment/process change to produce a different product</li> </ul>
<b>Quick changeover</b>	<p>Quick changeovers may be known by a number of alternative titles depending on the industry sector. In manufacturing quick changeovers may be referred to as:</p> <ul style="list-style-type: none"> <li>• single minute exchange of die (SMED)</li> <li>• single-digit set-up – performing a set-up activity in a single-digit number of minutes (i.e. fewer than ten)</li> <li>• one touch exchange of die (OTED) – literally, changing a die with one physical motion, such as pushing a button – broadly, an extremely simple procedure for performing a set-up activity</li> </ul> <p>While the term die is the traditional term, organisations that require changeovers using other equipment are also covered by this unit.</p> <p>This unit may not be applicable to a totally continuous operation producing only the one product, or simultaneous range of products. This is not applicable to a maintenance/pressure vessel inspection (PVI) shutdown as experienced by the continuous process manufacturers. However, where there are continuous operations on a campaign basis, it may be applied to the development of changeover procedures between campaigns or similar changeovers</p>
<b>Set-up work</b>	<p>Set-up time is the work required to change over a machine or process from one item or operation to the</p>

	<p>next item or operation. It can be divided into two types:</p> <ul style="list-style-type: none"> <li>• internal set-up work that can be done only when the machine or process is not actively engaged</li> <li>• external set-up work that can be done concurrently with the machine or process performing productive duties</li> </ul>
<b>Principles</b>	<p>The principles of quick changeover include:</p> <ul style="list-style-type: none"> <li>• the principles of efficient movement as well as an understanding of equipment features and aids, including jigs, fixtures, locating devices and mechanical aids which will reduce human effort and time required</li> </ul>
<b>Improved/eliminated</b>	<p>Activities which should be improved/eliminated include:</p> <ul style="list-style-type: none"> <li>• those which take time or are unreliable in terms of outcome</li> <li>• those which are difficult to do or have adverse OHS implications (e.g. repetitive strain injury, back injury and finger injuries)</li> </ul>
<b>Hazards and risks</b>	<p>Hazards and risks include those related to:</p> <ul style="list-style-type: none"> <li>• OHS</li> <li>• regulatory compliance</li> <li>• environment</li> <li>• commercial and contractual obligations</li> </ul> <p>An acceptable risk profile for changeovers is one which, at the minimum, meets regulatory and organisation requirements and does not increase the current risk profile</p>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plan</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other</li> </ul>

	format
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.



## **MSS405021A Develop a Just in Time system**

### **Modification History**

New unit, superseding MSACMT621A Develop a Just in Time (JIT) system\* - Not equivalent

\* Prerequisite MSACMC410A Lead change in a manufacturing environment - removed

### **Unit Descriptor**

Not applicable.

### **Application of the Unit**

This unit applies to a person responsible for planning and implementing a JIT system. It includes consulting with employees, suppliers and customers regarding the change. This may require identification of training and other employee support as well as identifying possible logistical support.

The unit includes kanban-based JIT systems but also applies to other sectors and systems where a traditional kanban-type JIT may not be suitable through the unit's coverage of JIT principles.

This unit requires the application of skills associated with communication in gathering, analysing and applying information, consulting with stakeholders, problem solving, and demonstrating initiative and enterprise. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into the JIT design.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |   |
|---|---|---|
| 1 | Design the JIT system/system improvements | 1.1 Identify value chain members<br>1.2 Consult with internal and external value chain members<br>1.3 Identify current storage/inventory in value chain<br>1.4 Determine flow authorisation indicators<br>1.5 Determine minimum and maximum operations rate<br>1.6 Determine lead time for product or service<br>1.7 Determine number of units per kanban<br>1.8 Draft workable procedures to implement JIT |
| 2 | Implement the JIT system/improvements     | 2.1 Consult with key internal stakeholders to develop solutions to JIT issues<br>2.2 Ensure all stakeholders have required JIT-related skills and related issues have been resolved<br>2.3 Liaise with key external members of the value chain to develop solutions to JIT issues<br>2.4 Develop implementation plan for JIT<br>2.5 Determine key measures of JIT   |
| 3 | Monitor the JIT                           | 3.1 Monitor key measures of JIT   |

- |        |     |  |
|--------|-----|--|
| system | 3.2 | Regularly liaise with key stakeholders seeking areas for improvement |
|        | 3.3 | Identify areas in need of improvement                                |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- analysing equipment, operations and value stream and determining best flow authorisation strategy, including:
  - form of kanban or flow authorisation indicator
  - integration with operations and other competitive systems and practices tools and techniques
  - key measures and monitoring strategy for JIT system
  - procedures to be adopted in the event of a non-conformance
- problem solving JIT issues and non-conformances to root cause

### Required knowledge

Required knowledge includes:

- needs of internal and external value chain members
- principles of JIT, including:
  - demand pull
  - flow authorisation
  - kanban
  - capability rate
  - monitoring
  - non-conformance procedures
- reasons for delays/storages/inventories in the value stream and methods of reducing/eliminating them
- methods of identifying skill gaps and methods of filling skill gaps

- key business objectives associated with implementing JIT
- principles of the operational processes relevant to the JIT implementation
- production data generated by the process and its application to JIT

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• develop a complete JIT system, including: <ul style="list-style-type: none"> <li>• implementation strategy</li> <li>• key measures</li> <li>• training and support strategy for employees and value chain members</li> <li>• procedures in the event of a non-conformance</li> </ul> </li> <li>• communicate and negotiate complex issues to a wide variety of individuals</li> <li>• supervise JIT implementation and suggest improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a</p>

	<p>combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>This unit may be assessed concurrently with:</p> <ul style="list-style-type: none"> <li>• MSS405002A Analyse and map a value stream, and/or</li> <li>• MSS405050A Determine and improve process capability.</li> </ul> <p>This unit is related to:</p> <ul style="list-style-type: none"> <li>• MSS402021A Apply Just in Time procedures</li> <li>• MSS403021A Facilitate a Just in Time system</li> </ul> <p>which cover the lowest and intermediate skill levels in competitive systems and practices respectively.</p> <p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<p><b>Competitive systems and practices</b></p>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<p><b>JIT</b></p>	<p>JIT is a production scheduling concept that calls for any item or service needed at a production operation, whether raw material, components, fuel, power, finished item, or anything else in between raw material and delivery to the final customer, to be produced and available precisely when needed, neither a moment earlier nor a moment later. JIT principles may also be applied to non-product based manufacturing operations (e.g. where services</p>

	must be delivered on demand, such as transport)
<b>Kanban</b>	<p>Kanban is a signal to authorise production or movement of an item to the next stage of production or operations. It is often a physical item for example a card, bin or sheet. When fully implemented, kanban operates according to the following rules:</p> <ul style="list-style-type: none"> <li>• all production and movement of parts, material or other necessary items takes place only as required by a downstream operation</li> <li>• the specific tool which authorises production or movement is called a kanban</li> </ul> <p>Kanban is typically applied to batch type operations and the production is measured in units produced. In continuous operations organisations, production is measured in terms of production rate (e.g. kg/h, tonne/day) and rate is increased/decreased according to the flow authorisation which may be a kanban (e.g. ticket or order from a supplier) or may be a SCADA signal from a remote facility (e.g. customer tank) saying that resupply is required or similar.</p> <p>In service operations a physical kanban may not be used – see flow authorisation indicator</p>
<b>SCADA</b>	<p>SCADA refers to:</p> <ul style="list-style-type: none"> <li>• a number of systems which automatically collect critical process data, perform required mathematical manipulations on it and then make control decisions and/or give required information personnel for action</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/ collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> </ul>

	<ul style="list-style-type: none"> <li>• after market support</li> </ul>
<b>Flow authorisation indicator</b>	<p>Flow authorisation indicator may include:</p> <ul style="list-style-type: none"> <li>• kanban bin, ticket or similar</li> <li>• other indicator of demand pull</li> </ul>
<b>Pull system</b>	<p>Pull system includes:</p> <ul style="list-style-type: none"> <li>• an operations planning system which makes to demand, rather than for stock or to a forecast</li> </ul>
<b>Cards/bins</b>	<p>Cards/bins include:</p> <ul style="list-style-type: none"> <li>• the indicators used for production authorisation and may be physical cards or bins or some other suitable indicator</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>
<b>Key measures</b>	<p>Key measures may include:</p> <ul style="list-style-type: none"> <li>• inventory levels</li> <li>• lead time</li> <li>• in full, on time and in specification (IFOTIS) delivery</li> <li>• productivity/production rate</li> <li>• other measures of pull through the value chain</li> <li>• quality</li> </ul>



## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405022A Design a process layout**

### **Modification History**

New unit, superseding MSACMT622A Design a process layout - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to design a process layout, typically a cellular flow, for either a jobbing shop or a continuous process manufacturer.

### **Application of the Unit**

This unit provides the skill for a technical expert to apply the principles of competitive systems and practices to process design layout as distinct from volume production layout. While the application of the unit may be for an initial layout, in many cases it is likely to be for the redesign of an existing layout.

The unit is written on the assumption that there is an existing process. Where this is not the case, then additional competency in equipment/process design and selection will also be required through units from an appropriate technical qualification or Training Package.

This unit requires the application of skills associated with problem solving, initiative, enterprise, planning and organising in order to design a process for the manufacture of enterprise products that incorporates team operations, product flow, infrastructure and the layout of the physical environment and related technology. This unit has a strong emphasis gathering, analysing and applying information.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |  |
|---|--|--|
| 1 | Identify the products and processes used in the organisation | 1.1 Obtain or develop a process map of the existing process<br>1.2 Identify all/main products/classes of products<br>1.3 Obtain forecast sales and sales pattern of products/classes<br>1.4 Obtain profiles of products/classes<br>1.5 Group the products/classes into compatible families   |
| 2 | Engineer the process   | 2.1 Make a preliminary selection of required equipment/technology/process for each process or product family<br>2.2 Estimate required resource times for each family<br>2.3 Calculate total resourcing required for each family<br>2.4 Estimate appropriate lot size<br>2.5 Determine viability of proposed families<br>2.6 Examine draft proposal for possible improvements in process consistent with the competitive systems and practices strategy of the organisation |
| 3 | Design the infrastructure                                    | 3.1 Consult on layout needs with all stakeholders<br>3.2 Identify physical infrastructure required by system   |

- 3.3 Identify information and control infrastructure required
  - 3.4 Identify work organisation required
  - 3.5 Identify occupational health and safety (OHS) and regulatory requirements to be taken into account
  - 3.6 Identify workforce development and training requirements
  - 3.7 Check the availability of required infrastructure and compatibility with requirements
- 
- 4 Layout the process
    - 4.1 Draft proposed process flow map
    - 4.2 Draft proposed configuration diagram
    - 4.3 Draft proposed space plan/layout
    - 4.4 Check availability of services/structural suitability, as appropriate
    - 4.5 Validate proposed layout with all relevant stakeholders
    - 4.6 Layout the process/work cell
    - 4.7 Develop implementation plan in liaison with relevant stakeholders
    - 4.8 Review layout after implementation

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating at all levels in the organisation and to individuals of different levels of literacy and numeracy
- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- producing process flow maps

- analysing the relationship between equipment, components, products, services and operators for existing and future layouts
- problem solving layout-related problems to root cause
- planning and organising implementation plans, including communication to stakeholders and any necessary training
- calculating and estimating size, volume and area and other layout related measures

## Required knowledge

Required knowledge includes:

- typical customer requirements, including:
  - order size
  - order pattern
- processing requirements of products and jobs
- capabilities and maintenance requirements (e.g. access and services) of equipment
- abilities and skills of workforce
- OHS and regulatory requirements that may affect layout
- business requirements from layout

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• analyse products, operations and equipment and determine efficiencies that can be achieved by improved layout</li> <li>• determine OHS and regulatory impacts on a layout</li> <li>• supervise implementation of layouts</li> <li>• analyse implemented layouts and suggest further improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> </ul>

	<ul style="list-style-type: none"> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of

the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Profiles</b>	<p>Profiles of products may include:</p> <ul style="list-style-type: none"> <li>• components/materials needed to manufacture</li> <li>• equipment/technology/processes required to manufacture</li> <li>• volume of activity to manufacture forecast amount</li> </ul>
<b>Compatible families</b>	<p>Compatible families include:</p>

	<ul style="list-style-type: none"> <li>products/classes requiring identical or similar operations equipment, technology or processes</li> </ul>
<b>Required resource times</b>	<p>Required resource times may include:</p> <ul style="list-style-type: none"> <li>set-up time</li> <li>equipment time</li> <li>person time</li> <li>process time</li> </ul>
<b>Lot size</b>	<p>Lot size may include:</p> <ul style="list-style-type: none"> <li>external lot size</li> <li>internal lot size</li> <li>transfer batch size</li> <li>kanban size</li> </ul>
<b>Viability</b>	<p>Viability includes:</p> <ul style="list-style-type: none"> <li>appropriate calculated processing times</li> <li>adequacy of equipment utilisation</li> <li>acceptable maintenance implications</li> <li>ability to meet OHS requirements</li> <li>ability to meet environmental requirements</li> <li>compliance with any legislative and regulatory requirements</li> <li>acceptable to stakeholders</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders include:</p> <ul style="list-style-type: none"> <li>customers</li> <li>employees</li> <li>equipment suppliers and contractors (especially if new equipment required)</li> </ul> <p>Depending on the process and location, stakeholders may also include:</p> <ul style="list-style-type: none"> <li>regulatory authorities</li> <li>local community representatives</li> <li>utilities (e.g. water and power)</li> </ul>
<b>Physical infrastructure</b>	<p>Physical infrastructure may include:</p> <ul style="list-style-type: none"> <li>containers</li> <li>material handling equipment</li> <li>utilities supply (e.g. steam, air, gas, electricity and water)</li> </ul>
<b>Information and control infrastructure</b>	<p>Information and control infrastructure may include:</p> <ul style="list-style-type: none"> <li>quality assurance</li> </ul>



	<ul style="list-style-type: none"><li>• statistical process control (SPC)/six sigma</li><li>• planning systems/software</li><li>• data collection and control systems/software</li></ul>
<b>Work organisation</b>	Work organisation includes: <ul style="list-style-type: none"><li>• number of personnel</li><li>• skills mix of workforce</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# MSS405023A Develop a levelled pull system for operations and processes

## Modification History

New unit, superseding MSACMT623A Develop a levelled pull system of manufacturing - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to develop and level a customer-driven demand pull system for operations and processes in order to balance the flow of work and minimise inventories.

## Application of the Unit

This unit primarily applies to volume-based manufacturing organisations. However, the skills covered by the unit may also be applied in other organisations where the business is based on high volume processes initiated by customer demand signals (e.g. orders). The unit covers the production planning skills needed to develop and level a demand pull system which meets the business needs of the organisation. This may apply to the initial development of a pull system, or the continuous improvement of an existing system.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Problem solving, initiative and enterprise, and planning and organising are required to determine effective operations sequences and flow systems. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into system designs.

Depending on the organisation and its operations the following units may also be relevant:

- *MSS402080A Undertake root cause analysis*
- *MSS405002A Analyse and map a value stream*
- *MSS405021A Develop a Just in Time system*
- *MSS405022A Design a process layout*
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## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Analyse production systems	1.1	Acquire an 'as is' value map of the process for all major products
		1.2	Separate repeated products from specials
		1.3	Consult with production, maintenance, supervisory and management workforce on current production system and processes
		1.4	Establish rate of flow required to meet customer demand
		1.5	Identify process steps causing problems
		1.6	Analyse inventories within process and determine causes of high inventories
		1.7	Determine costs of problems and inventories
		1.8	Develop improved flow sequence and future value map
2	Establish sequence	2.1	Identify equipment and processes which can be sequenced by co-location
		2.2	Identify equipment which is not suitable for co-location
		2.3	Identify pacemaker process

- |   |                                 |     |   |
|---|---------------------------------|-----|---|
|   |                                 | 2.4 | Establish/review location of equipment for desired sequencing                           |
| 3 | Initiate or develop flow system | 3.1 | Determine rate and variability of demand for product                                    |
|   |                                 | 3.2 | Compare capability of flow sequence to demand rate and variability                      |
|   |                                 | 3.3 | Set flow rate to level demand at pacemaker and handle variability                       |
|   |                                 | 3.4 | Identify trigger for pacemaker process  |
|   |                                 | 3.5 | Establish kanban system for other process parts   |
| 4 | Balance the work                | 4.1 | Determine target time per product   |
|   |                                 | 4.2 | Standardise work processes and operations and establish procedures to monitor variation |
|   |                                 | 4.3 | Adjust product/batch production to balance work   |
|   |                                 | 4.4 | Arrange for any required competency development of workforce                            |
|   |                                 | 4.5 | Arrange for implementation of system  |
|   |                                 | 4.6 | Monitor operation of system and take appropriate action                                 |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying and analysing production and other processes to identify variation from specifications
- solving problems to determine causes of variations to root cause
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- analysing long or critical process steps and determine if they are pacemaker step
- setting and standardising operational processes around the requirements of the pacemaker process
- planning and organising implementation of a levelled pull production system
- documenting process steps
- performing calculations and interpreting data, including charts and diagrams related to establishing rate of flow and variation in process steps

## Required knowledge

Required knowledge includes:

- technical and regulatory limits that must be adhered to in operations
- processing requirements of products or services offered by the organisation
- capabilities of equipment
- capabilities and skills of the workforce
- production planning techniques
- methods of calculating rates of demand and flow of work (e.g. takt and pitch)
- techniques for achieving a smooth and consistent flow of work, such as:
  - identifying pacemaker process
  - levelling the flow of work
  - balancing the allocation of resources
  - balancing the allocation of work
  - Just in Time (JIT)
  - Heijunka boxes
  - visual displays
- relationship of level of inventory to efficiency and waste

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• acquire a value stream map for current products and processes</li></ul>
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	<ul style="list-style-type: none"> <li>• analyse process</li> <li>• perform required calculations to determine flow rate and variability</li> <li>• correctly identify pacemaker process</li> <li>• balance the work</li> <li>• monitor implementation of a levelled pull system and suggest improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>

<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.
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## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted</p>
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	<p>so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Product</b>	<p>Product includes:</p> <ul style="list-style-type: none"> <li>individual products and product groups/families</li> </ul>
<b>Inventories</b>	<p>Inventories within process may include:</p> <ul style="list-style-type: none"> <li>cycle stock which reflects the replenishment quantity and frequency</li> <li>buffer stock to meet demand variability and forecast errors</li> <li>safety stock required to guard against quality and delivery failures upstream</li> </ul>
<b>Pacemaker</b>	<p>Pacemaker processes is that process which sets the pace for the flow of operations/work through the enterprise. Pacemaker processes may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>process steps which are significantly longer than other production stages</li> <li>critical technical or quality steps in the production process</li> </ul>
<b>Takt time</b>	<p>Takt time is the time required to complete one job cycle if the customer's time and volume expectations are to be met, i.e. the available time divided by the number of units required, and so may include, but is not limited to:</p> <ul style="list-style-type: none"> <li>time per piece where applied to piece work</li> <li>time per tonne or litre when applied to bulk product</li> <li>time per work item when applied to an office or service environment</li> <li>deadlines required to meet delivery dates when applied to project work</li> </ul>
<b>Pitch</b>	<p>Pitch is the takt time averaged over a defined period and with available resources giving the rate of flow required to meet customer demand</p>



<b>Balance work</b>	<p>Balance work means balancing:</p> <ul style="list-style-type: none"><li>• time of production</li><li>• effort required by workforce and equipment</li><li>• work organisation</li><li>• job design</li><li>• quality considerations</li><li>• waste and other cost considerations between stations/equipment/processes to achieve levelled pull within allowable time per product</li></ul> <p>Balance work consideration also means:</p> <ul style="list-style-type: none"><li>• undertaking adequate consultation with stakeholders</li><li>• meeting occupational health and safety (OHS) and environmental requirements</li><li>• any other regulatory and legislative requirements</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS405030A Optimise cost of a product or service

### Modification History

New unit, superseding MSACMT630A Optimise cost of product\* - Not equivalent

\* Prerequisite *MSACMT631A Undertake value analysis of product costs in terms of customer requirements* - removed

### Unit Descriptor

This unit of competency covers the skills and knowledge required to examine the costs of a product or service and determine methods of reducing costs.

### Application of the Unit

This unit applies to an individual who is required to undertake a detailed study of a product or service's costs, including analysing it by its cost components to determine the best method of lowering the cost overall. This unit differs from *MSS405031A Undertake value analysis of a product or process costs in terms of customer requirements*, in that it looks at all costs, including overheads and takes a wider and more traditional approach to the cost of the product. Information and cost reduction strategies gained from the application of this unit may support other cost approaches in the enterprise, including value stream costing.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information. Problem solving, initiative and enterprise, and planning and organising are required to calculate cost components and determine cost optimisation strategies. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into costing methods.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse total cost components of a product or service	1.1	Identify all cost components of product or service
		1.2	Allocate cost components to major categories, such as overhead, depreciation, energy, consumables and labour
		1.3	Distinguish between costs which directly deliver customer features/benefits and waste
2	Optimise costs	2.1	Analyse causes of costs which lead to customer features/benefit
		2.2	Determine methods of increasing the customer benefit/cost ratio
		2.3	Analyse causes of waste costs
		2.4	Determine methods of reducing/eliminating waste costs
		2.5	Analyse interactions between cost components
		2.6	Check that one method of reducing costs does not cause an increase in another cost/reduction in consumer benefit
		2.7	Check that cost reduction plans do not reduce required levels of regulatory compliance or occupational health and safety (OHS)
3	Implement cost optimisation	3.1	Develop cost optimisation plans
		3.2	Negotiate with relevant people to agree on implementation plans

- 3.3 Take actions to implement the cost optimisation
- 3.4 Monitor the implementation of the cost optimisation
- 3.5 Make adjustments to the plan, as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- communicating at all levels in the organisation and value chain and to audiences of different levels of literacy and numeracy
- identifying relevant cost component categories for organisation, product and process
- identifying customers, including final customer and features/benefits as valued by customers
- expressing customer features/benefits in cost terms
- determining application scope of cost reduction plan, including product/s, areas, employees and suppliers included in plan

### Required knowledge

Required knowledge includes:

- cost components of product
- major costs which are controllable (and how to control them)
- concept and types of waste (muda)
- interrelationship of cost components and costs and benefits, including:
  - methods of estimating costs/benefits
  - acceptable benefit/cost ratios

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• determine relevant cost categories for a product or service</li> <li>• determine which costs are waste</li> <li>• develop a cost optimisation plan</li> <li>• implement and monitor the plan .</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads, hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace project(s)</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and</p>

	disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul>
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	<p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product. Within operations, categories of waste include:</p> <ul style="list-style-type: none"> <li>excess production and early production</li> <li>delays</li> <li>movement and transport</li> <li>poor process design</li> <li>inventory</li> <li>inefficient performance of a process</li> <li>making defective items</li> <li>activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>
<b>Cost</b>	<p>Cost includes:</p> <ul style="list-style-type: none"> <li>the monetary value of expenditures able to be directly identified for supplies, services, direct labour, materials, components, cost of inventory, faults and reworks, rejects/scrap, equipment and other items used in the production of the product</li> <li>allocations and estimates for indirect costs (e.g. indirect labour, rent, energy, water and cost of capital) where a direct monetary value cannot be identified</li> </ul>
<b>Cost optimisation plans</b>	<p>Cost optimisation plans should include:</p> <ul style="list-style-type: none"> <li>application scope (e.g. product/s, services, areas, employees and suppliers included in plan)</li> <li>target costs and target cost reductions</li> <li>implementation period</li> <li>method of monitoring</li> <li>method of communicating progress to stakeholders</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.



## **MSS405031A Undertake value analysis of product or process costs in terms of customer requirements**

### **Modification History**

New unit, superseding MSACMT631A Undertake value analysis of product costs in terms of customer requirements\* - Not equivalent

\* Prerequisite *MSACMT230A Apply cost factors to work practices* - removed

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required by an employee who is required to analyse products and processes to determine the value-adding factors, including design and processing costs that most impact on meeting customer requirements and which may also include competitor benchmarking. The unit also includes implementing identified changes that increase cost-efficiency. The unit may be applied individually or in a team environment.

In this unit an employee uses an analysis of the benefits/features which a customer perceives to be in a product or service as a basis for determining appropriate or unnecessary cost and so identifying and reducing waste.

### **Application of the Unit**

This unit applies to an individual who undertakes the value analysis of a product or service, establishing the features/benefits obtained by customers from the cost components relating to those benefits. From this appropriate or waste cost will be determined and actions taken to either reduce waste or improve saleability.

This unit differs from *MSS405030A Optimise cost of a product or service*, in that it requires costs to be measured against customer features/benefits and is designed to contribute to value stream costing. *MSS405030A Optimise cost of a product or service* complements this unit by allowing detailed analysis of all costs, including overheads.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information. Problem solving, initiative and enterprise, and planning and organising are required to determine cost-efficiencies. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into costing methods.

### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse customer benefits to determine appropriate or waste costs	1.1	Analyse product or service to determine features/benefits perceived by customer in product
		1.2	Analyse cost components of product or service and determine those which deliver customer features/benefits and those which are either appropriate or waste
		1.3	Determine any additional features that may be added to improve saleability
		1.4	Analyse waste cost components and allocate to direct and indirect cost categories
		1.5	Determine options for reducing direct and indirect waste costs
		1.6	Select cost-related actions which maximise customer benefits and minimise costs
		1.7	Where required, undertake competitor benchmarking to provide reference points

2	Analyse performance variance	2.1	Identify waste processing or operational steps for product or service following completion of customer benefit analysis
		2.2	Analyse all costs and determine methods of reducing costs/waste
		2.3	Develop plan and recommendations for actions required to achieve cost improvement or added customer benefits to improve saleability
		2.4	Submit plan and recommendations to stakeholders

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- communicating at all levels in the organisation and value chain and to audiences of different levels of literacy and numeracy
- determining customer features/benefits added to products at each operational step
- relating cost components to customer features/benefits
- distinguishing between direct and indirect costs
- identifying relevant cost component categories for product
- determining application scope of cost reduction plan, including products, areas, employees and suppliers included in plan
- undertaking competitor benchmarking for reference in cost analysis

### Required knowledge

Required knowledge includes:

- customer features/benefits from products
- impact of customer features/benefits on sales, market share and firms profitability
- performance and cycle times for products made or service provided
- major costs which are controllable (and how to control them)
- types of waste (muda)
- methods of reducing waste

- methods of reducing cycle time
- desirability of improving performance and methods of reducing cycle time

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• identify customer features/benefits for a product and their impact on market share or saleability of the product</li> <li>• determine direct/indirect costs in a product</li> <li>• determine which costs are waste</li> <li>• analyse cycle times and make suggestions for reduction in cycle time</li> <li>• develop a cost/waste reduction plan.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> </ul>

	<ul style="list-style-type: none"> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and</li> </ul>
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	<p>analysis</p> <ul style="list-style-type: none"> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product.</p> <p>Within operations, categories of waste include:</p> <ul style="list-style-type: none"> <li>• excess production and early production</li> <li>• delays</li> <li>• movement and transport</li> <li>• poor process design</li> <li>• inventory</li> <li>• inefficient performance of a process</li> <li>• making defective items</li> <li>• activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>
<b>Cost</b>	<p>Cost includes:</p> <ul style="list-style-type: none"> <li>• the monetary value of expenditures able to be directly identified for supplies, services, direct labour, components, cost of inventory, faults and reworks, rejects/scrap, equipment and other items used in the production of the product</li> <li>• allocations and estimates for indirect costs (e.g. indirect labour, rent, power and water) where a direct monetary value cannot be identified</li> </ul>

<b>Determine customer feature/benefits</b>	This unit does not require that customer features/benefits must be obtained by the person undertaking the unit directly contacting customers. The features/benefits may have already been determined by sales and marketing personnel and passed on to operations. However, the unit requires that the product or process must be analysed to determine how the product or process supplies the features/benefits and by which step/feature of the product or process
<b>Performance</b>	Performance is may be thought of as the rate of output or delivery of the performance or service compared to the rate required to meet demand for the product or service
<b>Cycle time</b>	Cycle time includes: <ul style="list-style-type: none"> <li>the normal time to complete an operation on a product</li> </ul>
<b>Pull</b>	Pull is the concept of producing to demand, rather than for stock or some forecast

## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405032A Analyse cost implications of maintenance strategy**

### **Modification History**

New unit, superseding MSACMT632A Analyse cost implications of maintenance strategy - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to analyse the cost implications of different maintenance strategies and to adjust or adopt a strategy to minimise or eliminate unnecessary costs.

### **Application of the Unit**

This unit applies to an individual in an organisation who is selecting or reviewing its proactive maintenance strategy. While technical factors are significant in the choice of maintenance strategy and tools, cost factors will also impact on the selection of a maintenance strategy. This unit covers the cost analysis of maintenance strategies and complements the technical analysis covered in MSS405081A Develop a proactive maintenance strategy. The technical analysis may be performed by the same or a different person to the person undertaking the cost analysis.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying costing information and consulting with maintenance personnel. Problem solving, initiative and enterprise, and planning and organising are required to analyse and estimate the cost of maintenance strategies.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |   |
|---|--|---|
| 1 | Analyse cost components of maintenance       | 1.1 Determine cost of failure of plant/equipment<br>1.2 Determine cost of a planned maintenance shutdown activity, including costs of re-start<br>1.3 Determine cost of maintenance for a planned activity<br>1.4 Determine cost of maintenance for an unplanned activity<br>1.5 Determine costs of condition monitoring<br>1.6 Identify cost implications of different maintenance strategies  |
| 2 | Estimate life cycle costs of plant/equipment | 2.1 Determine initial capital cost<br>2.2 Estimate servicing, maintenance and repair costs<br>2.3 Estimate production and other costs associated with service, maintenance and repair<br>2.4 Determine depreciation and other applicable allowances<br>2.5 Estimate ancillary costs, such as training, commissioning and productivity loss<br>2.6 Estimate technological life and costs of changing to current technology/costs of retaining obsolete equipment<br>2.7 Estimate annualised costs in present value terms<br>2.8 Identify life cycle cost implications for strategy |

- |   |  |     |  |
|---|--|-----|--|
| 3 | Liaise with proactive maintenance strategy developer | 3.1 | Identify cost implications for different strategies                          |
|   |  | 3.2 | Negotiate a strategy which minimises total costs                             |
|   |  | 3.3 | Monitor the implementation of the strategy to ensure the costs are minimised |
|   |  | 3.4 | Make required adjustments to strategy  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking financial modelling and calculations relevant to different maintenance scenarios
- reading and interpreting charts and diagrams
- communicating with stakeholders, including technical and production staff to identify implications of maintenance strategies
- identifying sources of information on depreciation, allowances and ancillary costs
- analysing data and qualitative information on impact of different maintenance strategies on meeting customer needs
- solving problems to root cause
- preparing strategies and recommendations for stakeholders

### Required knowledge

Required knowledge includes:

- techniques, calculations and data used in different maintenance strategies
- cost components of maintenance strategies
- interrelationship of cost components and maintenance activities

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify and analyse data and other information on current and potential maintenance strategies</li> <li>• communicate effectively with operators, maintenance personnel, engineers and other stakeholders on implications of maintenance strategies</li> <li>• make recommendations on optimal maintenance strategies from a cost perspective.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made</p>

	to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> </ul>
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	<ul style="list-style-type: none"> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Maintenance strategies and techniques</b>	<p>Maintenance strategies and techniques may include:</p> <ul style="list-style-type: none"> <li>• total productive maintenance (TPM)</li> <li>• reliability centred maintenance (RCM)</li> <li>• root cause analysis (RCA)</li> <li>• mean time between failures (MTBF)</li> <li>• failure mode and effects analysis (FMEA)</li> <li>• condition monitoring</li> </ul>
<b>Cost components of maintenance</b>	<p>For costing purposes, maintenance strategies should include:</p> <ul style="list-style-type: none"> <li>• direct costs, such as labour and materials, and also include comparison with cost of equipment replacement, re-engineering, and breakdown repair strategies, as well as cost of lost production under different maintenance strategies</li> </ul>
<b>TPM</b>	<p>TPM is an application of total quality management to maintenance with the intention of increasing reliability, getting it right first time and increasing OEE</p>
<b>RCM</b>	<p>RCM moves maintenance from reactive, or even planned/programmed towards a focus on uptime and OEE</p>
<b>RCA</b>	<p>RCA is a formal problem solving technique. In RCA there are many possible causes of any problem. Eliminating some will have no impact, while eliminating others will ameliorate the problem. However, elimination of the root cause will eliminate the problem completely. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem</p>
<b>OEE</b>	<p>OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is:</p>

	<p><i>OEE = availability x performance x quality rate</i></p> <p>where:</p> <ul style="list-style-type: none"> <li>• availability takes into account losses due to breakdown, set-up and adjustments</li> <li>• performance takes into account losses due to minor stoppages, reduced speed and idling</li> <li>• quality rate takes into account losses due to rejects, reworks and start-up waste</li> </ul>
<b>Uptime</b>	Uptime refers to the overall availability of the plant (it is the inverse of downtime) or the unavailability of the plant. Ideal uptime is 100%
<b>MTBF</b>	<p>MTBF is one key measure of the effectiveness of a maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MTBF is reducing, then it is an indicator that the maintenance regime is failing.</p> <p>There are many possible causes of any problem. Eliminating some will have no impact, others will ameliorate the problem. However, elimination of the root cause will eliminate the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem.</p> <p>Depending on the equipment, operations and procedures of the organisation, alternative statistical records of maintenance and maintenance related events may be substituted for MTBF providing they relate strategies for improving OEE.</p>
<b>FMEA</b>	<p>FMEA is a systematic approach that identifies potential failure modes in a system, product, or process caused by either design or operations/assembly process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring.</p> <p>Some industry sectors have highly adapted forms of FMEA and may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification.</p> <p>HAZOP) is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to</p>

	process stability.
<b>Condition monitoring</b>	In this unit condition monitoring is used to describe the process of analysing the implications of condition monitoring data for proactive maintenance whether it be obtained from non-destructive testing (NDT) reports, visual assessment by experts, diagnostic reports obtained from SCADA or other enterprise or equipment software and product or process quality analyses

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405040A Manage 5S system in an organisation**

### **Modification History**

New unit, superseding MSACMT640A Manage 5S system in a manufacturing environment - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required for the overall management of the 5S system in an organisation.

### **Application of the Unit**

This unit applies to an individual who is responsible for ensuring the smooth operation and continuous improvement of the 5S system in an organisation. This may be for an initial introduction of, or for the ongoing implementation and continuous improvement resulting from, 5S.

This unit requires the application of skills associated with problem solving, planning, communication and teamwork.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.



## Elements and Performance Criteria

1	Organise an appropriate environment for 5S	1.1	Ensure managers and other key stakeholders support and understand 5S
		1.2	Arrange for team leaders to develop/maintain skills required for 5S
		1.3	Ensure team leaders are developing/maintaining skills required in their team members
		1.4	Ensure procedures and work practices reflect 5S needs and regulatory requirements
		1.5	Practise 5S in own work
		1.6	Eliminate roadblocks to 5S
2	Audit 5S implementation	2.1	Undertake spot checks of compliance
		2.2	Review workplace and records for indicators of compliance/non-compliance
		2.3	Encourage all levels of the workforce to routinely suggest areas for improvement
		2.4	Discuss 5S routinely with team leaders to seek ideas for implementation of improvement suggestions and encourage identification of non-conformance
3	Improve 5S	3.1	Negotiate solutions to non-conformances
		3.2	Implement agreed solutions
		3.3	Work with team leaders to develop opportunities for improvements
		3.4	Provide necessary resources for improvements
		3.5	Ensure procedures and practices change to reflect

improvements

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with stakeholders on aims and objectives of 5S program in the organisation
- mentoring and monitoring team leaders in their skills and knowledge of 5S and the organisations objectives for 5S
- conducting formal and informal meetings and explaining 5S and related concepts
- reviewing regulatory requirements for implications for 5S implementation
- facilitating team goals, activities and communications and accessing resources
- problem solving 5S poor performance and problems to root cause
- identifying requirements and negotiating resources for 5S implementation across the organisation
- planning and prioritising activities of teams
- identifying problems in 5S implementation caused by gaps in skills and/or knowledge and developing options to address them

### Required knowledge

Required knowledge includes:

- organisation operations and structure
- principles of efficient workplace organisation
- purposes and methodology of 5S
- operation procedures relevant to jobs in the organisation
- relevant regulatory requirements
- processes for identification of skill gaps
- methods of addressing skill gaps
- ways of encouraging team leaders and operators to find and suggest areas for improvement
- methods of making/recommending improvements
- methods of accessing required resources
- non-conformance, what they are, assessment of severity and action to be taken

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• encourage and monitor a systematic approach to implementing 5S</li> <li>• analyse areas and records for evidence of 5S conformance/non-conformances</li> <li>• manage non-conformances in implementation of 5S</li> <li>• lead and motivate others in achieving 5S outcomes and making improvements to the 5S systems.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads, hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul>

	<p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> </ul>
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	<ul style="list-style-type: none"> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> <li>• formulas/recipes</li> <li>• batch sheets</li> <li>• temporary instructions and similar instructions provided for the smooth running of the plant</li> <li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li> <li>• government regulations</li> </ul> <p>Procedures may be:</p> <ul style="list-style-type: none"> <li>• written, verbal, computer-based or in some other format</li> </ul>
<b>Roadblocks</b>	<p>Roadblocks include:</p> <ul style="list-style-type: none"> <li>• all factors which are inhibiting the smooth implementation of 5S</li> </ul>
<b>5S</b>	<p>5S is a system of work organisation originally developed in Japan based around housekeeping principles. A close translation of the five stages in the housekeeping approach is:</p> <ul style="list-style-type: none"> <li>• sort</li> <li>• set in order</li> <li>• shine</li> <li>• standardise</li> <li>• sustain</li> </ul>
<b>Sort</b>	<p>Sort involves keeping only what is absolutely necessary</p>

	<p>for the processes in the work area. Sort includes:</p> <ul style="list-style-type: none"> <li>clearing the work area of all non-essential equipment and materials</li> </ul> <p>Non-essential items include:</p> <ul style="list-style-type: none"> <li>those not required to either produce product, conduct process or operations or make required adjustments to equipment during process or operations</li> </ul>
<b>Set in order</b>	<p>Set in order includes:</p> <ul style="list-style-type: none"> <li>assigning required equipment and materials appropriate locations in the work area (locations should be clearly marked and labelled to show the item and proper location)</li> </ul>
<b>Shine</b>	<p>Shine includes:</p> <ul style="list-style-type: none"> <li>keeping the work area clean at all times. This should be carried out to a regular daily schedule against allowed time and, on most occasions, at the end of a job</li> </ul>
<b>Standardise</b>	<p>Standardising includes:</p> <ul style="list-style-type: none"> <li>activities that help maintain the order and the housekeeping standards</li> <li>using procedures and checklists developed from a procedure</li> </ul>
<b>Sustain</b>	<p>Sustain includes:</p> <ul style="list-style-type: none"> <li>making sure that daily activities are completed every day regardless of circumstance</li> <li>undertaking inspections, including: <ul style="list-style-type: none"> <li>informal inspections carried out often, at least weekly</li> <li>formal inspections carried out at least monthly</li> </ul> </li> </ul> <p>Specific actions should be followed up to generate continuous improvement</p>
<b>Items in work area</b>	<p>Items in work area may include:</p> <ul style="list-style-type: none"> <li>tools</li> <li>jigs/fixtures</li> <li>materials/components</li> <li>plant and equipment</li> <li>manuals</li> <li>personal items (e.g., lunch boxes and posters)</li> <li>safety equipment and personal protective equipment</li> </ul>

	<ul style="list-style-type: none"><li>• other items which happens to be in the work area</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS405050A Determine and improve process capability

### Modification History

New unit, superseding MSACMT650A Determine and improve process capability\* - Equivalent

\* New prerequisite *MSS404052A Apply statistics to operational processes* superseding MSACMT452A Apply statistics to processes in manufacturing

### Unit Descriptor

This unit of competency covers the skills and knowledge required to determine the actual (as distinct from design) capability of a process and then to analyse that process to remove assignable causes and reduce random causes. This would typically be done by a manager or technical expert support person either working in a team, or in close liaison with key stakeholders. Process capability is typically calculated using standard deviations.

### Application of the Unit

This unit applies to an individual (who may be a production manager, plant/process engineer, technical specialist or similar) who is responsible for developing plans to stabilise and then improve process capability and following agreement the implementation of the plans to improve process capability. The organisation may use either a six sigma or three sigma process.

This unit primarily requires the application of skills associated with communication in gathering and analysing data and consulting with relevant personnel. Teamwork, problem solving, initiative and enterprise, and planning and organising are required to determine causes to variations and implement solutions. This is done in an environment using computer technology and also requires aspects of self-management and learning to ensure feedback and new learning is integrated into process improvements and operations management control systems.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MSS404052A Apply statistics to operational processes



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Obtain data for process capability study	1.1	Identify the process requiring capability analysis including relevant procedures
		1.2	Identify customer specifications for product or service
		1.3	Obtain process capability data
2	Analyse data	2.1	Identify assignable causes of variation in liaison with relevant personnel
		2.2	Develop solutions to eliminate variation due to assignable causes in liaison with relevant personnel
		2.3	Analyse random variations for possible causes in liaison with relevant personnel
		2.4	Confirm causes of random variation
		2.5	Develop solutions to reduce random variations in liaison with relevant personnel
3	Take action to improve process	3.1	Develop plans to implement solutions
		3.2	Liaise with relevant personnel to implement solutions

capability	3.3	Gain necessary approvals, as required
	3.4	Monitor implementation and make adjustments, as required
	3.5	Determine new/revised process capability
	3.6	Implement revised process capability regime

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using a variety of statistical methods and calculations
- communicating and negotiating at all levels in the organisation and value stream and with individuals of different levels of literacy and numeracy
- negotiating with employees, suppliers and customers, where necessary, to achieve access to, or collection of, data
- planning process and data collection changes required for process improvement, including:
  - objectives
  - performance indicators to be monitored to indicate success of change
  - resources required
  - training required
  - communication and liaison required with employees, suppliers and customers
  - implementation period required
- analysing variations and categorising into assignable and random cause
- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- working in and leading teams for data collection and process improvement
- using software computers and terminals, as required, to collect and analyse data

### Required knowledge

Required knowledge includes:

- data collection methods
- data processing techniques required to establish variability and normal distribution
- calculate three sigma or six sigma processes, as relevant

- random and non-random results and processes for recognition of assignable causes
- causes of different types of non-random results
- causes of random variation
- process understanding sufficient to translate the data into variations in the process and determine methods of controlling them

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• collect or obtain data relevant process capability data from a variety of sources data</li> <li>• work with people and analyse data to determine assignable causes</li> <li>• plan and prepare improvement proposals</li> <li>• monitor implementation of improvement proposals.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> </ul>

	<ul style="list-style-type: none"> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> </ul>
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	<ul style="list-style-type: none"> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Six sigma</b>	<p>Six sigma refers to:</p> <ul style="list-style-type: none"> <li>• a statistical tool for recording defects and determining capability which equates to only 3.4 defects per million opportunities for each product or service transaction</li> </ul> <p>Six sigma is also used as a general term covering a competitive systems and practices approach. Six sigma training typically covers several units of competency in this Training Package</p>
<b>Three sigma</b>	<p>Three sigma refers to:</p> <ul style="list-style-type: none"> <li>• a traditional statistical process control uses three sigma limits which equates to 3 defects per thousand opportunities for each product or service transaction</li> </ul>
<b>Process capability data</b>	<p>Process capability data includes:</p> <ul style="list-style-type: none"> <li>• customer requirements for product or service</li> <li>• process stability (control chart) performance</li> <li>• other charts and data</li> </ul>
<b>Procedures</b>	<p>Procedures may include:</p> <ul style="list-style-type: none"> <li>• work instructions</li> <li>• standard operating procedures</li> </ul>

	<ul style="list-style-type: none"><li>• formulas/recipes</li><li>• batch sheets</li><li>• temporary instructions and similar instructions provided for the smooth running of the plant</li><li>• good operating practice as may be defined by industry codes of practice (e.g. good manufacturing practice (GMP) and responsible care)</li><li>• government regulations</li></ul> <p>Procedures may be:</p> <ul style="list-style-type: none"><li>• written, verbal, computer-based or in some other format</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS405052A Design an experiment

### Modification History

Release 2 - Prerequisite unit code corrected - MSS404052A

Release 1 - New unit, superseding MSACMT652A Design an experiment\* - Equivalent

\* New prerequisite *MSS404052A Apply statistics to operational processes* superseding MSACMT452A Apply statistics to processes in manufacturing

### Unit Descriptor

This unit of competency covers the skills and knowledge required to design experiments. The design of experiments is generally undertaken as part of black-belt six sigma but may also be undertaken independently.

### Application of the Unit

This unit applies to a technical expert who is required to design and implement experiments aimed at making breakthrough improvements in the process. They will work with other members of the process team in doing this.

This unit primarily requires the application of skills associated with problem solving, initiative and enterprise, and planning and organising skills in order to identify, implement and evaluate an experiment. Communication skills associated with gathering, interpreting and documenting information are required.

Where this unit forms part of a suite of six sigma then the following units will also be relevant:

- *MSS403010A Facilitate change in an organisation implementing competitive systems and practices*
- *MSS403051A Mistake proof an operational process*
- *MSS404081A Undertake proactive maintenance analyses*
- *MSS405002A Analyse and map a value stream*
- *MSS405011A Manage people relationships*
- *MSS405050A Determine and improve process capability*
- *MSS405053A Manage application of six sigma for process control and improvement*
- *MSAPMSUP390A Use structured problem solving tools.*
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### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

MSS404052A Apply statistics to operational processes

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Choose an improvement project	1.1	Review a process/value stream map
		1.2	Identify areas in need of improvement
		1.3	Select a process/value stream area for analysis and improvement
		1.4	Determine the objective of the experiment in consultation with relevant stakeholders
2	Design the experiment	2.1	Select appropriate factorial design
		2.2	Estimate signal to noise ratio
		2.3	Determine required number of runs and factorial fraction
		2.4	Determine resolution
		2.5	Design a sequential series of experiments
		2.6	Calculate resource requirement for this design



- |   |  |     |  |
|---|--|-----|--|
|   |  | 2.7 | Determine whether resource requirements are practical in consultation with relevant stakeholders |
|   |  | 2.8 | Modify experiment, if required, to match available resources                                     |
|   |  | 2.9 | Determine/develop required metrics   |
| 3 | Conduct the experiment                       | 3.1 | Conduct first run of experiment  |
|   |  | 3.2 | Replicate in random order for required number of runs  |
|   |  | 3.3 | Block out known sources of variation   |
|   |  | 3.4 | Conduct other experiments in series  |
|   |  | 3.5 | Record data/have data recorded   |
| 4 | Analyse and confirm the experimental results | 4.1 | Identify aliases/confounding of variables/results  |
|   |  | 4.2 | Analyse data using statistics pack or similar  |
|   |  | 4.3 | Interpret analysed data in line with objectives  |
|   |  | 4.4 | Identify confidence level of analysed data   |
|   |  | 4.5 | Design experiment to confirm correlations identified   |
|   |  | 4.6 | Conduct confirming experiment  |
|   |  | 4.7 | Analyse data from confirming experiment  |
|   |  | 4.8 | Confirm results (or conduct further experiments)   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing existing statistics and other data for relevance to the experiment

- determining where additional data is required and developing strategies for acquisition
- undertaking self-directed problem solving and decision-making
- solving problems
- communicating complex issues and techniques to stakeholders
- documenting procedures and results
- producing a range of charts and generating and validating required data for inclusion
- using statistics packs

## Required knowledge

Required knowledge includes:

- charting, such as:
  - Pareto charts
  - main effects plots
  - scatter plots
  - interaction plots
  - contour plots
  - response surface plots
- statistical principles and analysis, such as:
  - analysis of means (ANOM)
  - prediction equations
  - analysis of variance (ANOVA)/one-way ANOVA
  - desirability function
  - hit a target
  - advanced graphical data analysis
  - multi-variate planning
  - variation trees and funneling
  - hypothesis testing
  - central limit theorem
  - statistical analysis roadmap
  - analysis for means and t-test
  - correlation and regression
- factorial analysis principles and methods, such as:
  - multi-variate analysis
  - Taguchi S/N ratios
  - 2/3 level factorial
  - Taguchi L8
  - 2/4-1 half fraction
  - Plackett-Burman 8-run

- full factorial
- acceptance criteria/confidence levels

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• design an experiment relevant to improvement strategies and targets of the organisation</li> <li>• conduct an experiment</li> <li>• confirm results, including conduct of confirming experiments.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> </ul>

	<ul style="list-style-type: none"> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> </ul>
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	<ul style="list-style-type: none"> <li>breakthrough improvement (kaizen blitz)</li> <li>cause/effect diagrams</li> <li>overall equipment effectiveness (OEE)</li> <li>takt time</li> <li>process mapping</li> <li>problem solving</li> <li>run charts</li> <li>standard procedures</li> <li>current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Improvement</b>	<p>Improvement includes:</p> <ul style="list-style-type: none"> <li>an improvement in performance of an area/section or the whole enterprise as measured in terms of customer features/benefits</li> </ul>
<b>Objective of the experiment</b>	<p>Objective of the experiment may include:</p> <ul style="list-style-type: none"> <li>screen factors to find the critical few</li> <li>optimise a few critical factors</li> <li>solve process problems</li> <li>reduce waste</li> <li>increase reliability</li> </ul>
<b>Factorial design</b>	<p>Factorial design may include:</p> <ul style="list-style-type: none"> <li>2/3 level factorial</li> <li>Taguchi L8</li> <li>2/4-1 half fraction</li> <li>Plackett-Burman 8-run</li> <li>full factorial</li> </ul>
<b>Signal-to-noise ratio</b>	<p>Signal-to-noise ratio may be estimated from:</p> <ul style="list-style-type: none"> <li>previous experiment design experience</li> <li>previous process capability studies</li> <li>statistical process control data</li> <li>estimated from other sources</li> </ul>
<b>Resolution</b>	<p>Resolution is typically:</p> <ul style="list-style-type: none"> <li>Resolution III design: A design where main factor</li> </ul>

	<p>effects are confounded with two factor and higher order interactions</p> <ul style="list-style-type: none"> <li>Resolution IV design: A design where main effects are confounded with three factor and higher order interactions and all two factor interactions are confounded with two factor interactions and higher order interactions</li> <li>Resolution V design: A design where main effects are confounded with four factor and higher order interactions and two factor interactions are confounded with three factor interactions and higher order interactions</li> </ul>
<b>Sequential series of experiments</b>	<p>A typical series of experiments consists of:</p> <ul style="list-style-type: none"> <li>a screening design (fractional factorial) to identify the significant factors</li> <li>a full factorial or response surface design to fully characterise or model the effects</li> <li>confirmation runs to verify results</li> </ul>
<b>Required metrics</b>	<p>Required metrics may include:</p> <ul style="list-style-type: none"> <li>quantitative measures normally associated with the process</li> <li>other quantitative measures relevant to the experiment</li> <li>ranking systems for normally qualitative measures, such as defectives</li> </ul>
<b>Statistics pack</b>	<p>Typical statistics packs include:</p> <ul style="list-style-type: none"> <li>minitab</li> <li>JMP</li> <li>spreadsheets, such as Excel, particularly with specific add-ons, such as Sigma XL, Analyse It or other add-ons</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405060A Develop the application of enterprise control systems in an organisation**

### **Modification History**

New unit, superseding MSACMT660A Develop the application of enterprise systems in manufacturing - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to continuously modify and improve or develop new enterprise-wide information technology (IT) based control systems, such as Supervisory Control and Data Acquisition (SCADA), Enterprise Resource Planning (ERP), Materials Resource Planning (MRPII) and similar. Typically the development of such a system will be in liaison with an appropriate technical expert who may be an internal expert or an external consultant.

### **Application of the Unit**

This unit applies to an individual responsible for the development and implementation of new systems or modifications/changes to the current system. While the individual might generate the ideas for change themselves and also undertake a significant part of the final implementation, they may also be working closely with an appropriate technical expert (such as the software system supplier) who may actually make the modifications.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Teamwork, problem solving, initiative and enterprise, and planning and organising skills are required to determine and implement effective enterprise systems and modifications. This unit also requires computer skills and aspects of self-management and learning to ensure feedback and new learning is integrated into system planning.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Monitor information and control needs of organisation	1.1	Check the use of current information
		1.2	Check the operation of current control systems
		1.3	Communicate regularly with key information users regarding any new or changed information control needs, including information needs from and to value stream
		1.4	Identify short comings in information and control provision
		1.5	Take appropriate action on information and control needs to meet organisational needs
2	Check the current system against organisation needs	2.1	Check the routine use of the system
		2.2	Check any system alarm or non-conformance notification and control operation
		2.3	Communicate regularly with key stakeholders about current system use and application
		2.4	Determine effect of non-conformance on enterprise system

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|---|---|-----|---|
|   |   | 2.5 | Identify problems/issues  |
|   |   | 2.6 | Take appropriate action on problems and issues  |
| 3 | Determine developments needed in a new or significantly modified system | 3.1 | Identify needs requiring a new system or development of modifications to the current system   |
|   |   | 3.2 | Draft scope, specifications and outcomes required   |
|   |   | 3.3 | Liaise with key stakeholders and relevant technical experts to refine scope, specifications and outcomes needed in new or modified system |
|   |   | 3.4 | Agree final scope, specifications and outcomes  |
| 4 | Develop system  | 4.1 | Develop project plan  |
|   |   | 4.2 | Ensure ongoing consultation with all relevant stakeholders  |
|   |   | 4.3 | Manage development project  |
|   |   | 4.4 | Manage trialling of modified system   |
|   |   | 4.5 | Ensure modified system meets organisational requirements  |
| 5 | Implement modified system   | 5.1 | Liaise with all affected personnel  |
|   |   | 5.2 | Develop and agree an implementation strategy  |
|   |   | 5.3 | Ensure all personnel have required skills   |
|   |   | 5.4 | Implement modified system   |
|   |   | 5.5 | Monitor implementation and modify, as required  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

## Required skills

Required skills include:

- identifying organisation needs from enterprise control system, including:
  - critical features (e.g. occupational health and safety (OHS), regulatory compliance and emergency shutdown)
  - essential features and operation controls
  - access levels and access security
  - cost of installation and operation
  - interfaces (e.g. human-machine, machine-machine, and system-system, e.g. SCADA with financial control systems)
- correctly accessing and inputting information
- communicating with stakeholders on information and control requirements
- matching monitoring, control and reporting capability of system to organisation requirements
- analysing features of enterprise system and determining training needs
- solving problems to root cause
- monitoring trials and initial implementation of enterprise control system

## Required knowledge

Required knowledge includes:

- capability of resource planning/SCADA systems, as appropriate
- information and control needs of organisation/process
- project management
- support/training/skill development mechanisms available for access by personnel

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• analyse organisation needs and match to enterprise control system features</li><li>• determine critical features required in enterprise control system</li><li>• modify system as a result of trials or changing needs.</li></ul>
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<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<p><b>Method of assessment</b></p>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<p><b>Guidance information for assessment</b></p>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as SCADA software, ERP systems, MRP and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>SCADA</b>	<p>SCADA refers to:</p> <ul style="list-style-type: none"> <li>• a number of systems which automatically collect critical process data, perform required mathematical</li> </ul>

	<p>manipulations on it and then make control decisions and/or give required information personnel for action</p> <p>In the continuous operations sector, the SCADA system is sometimes integrated into other sophisticated computer control systems, such as distributed control system (DCS) and indeed these systems do merge in advanced systems. These organisations may simply refer to their SCADA as the DCS or other similar term (such as the proprietary name of the computer system)</p>
<b>Resource planning</b>	<p>Planning software is a general term applied to a number of software systems which integrate a range of business information, such as:</p> <ul style="list-style-type: none"> <li>• finance</li> <li>• logistics maintenance and production</li> </ul> <p>It is frequently referred to by names, such as ERP and MRP/MRP II</p>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value adding and non value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## **Custom Content Section**

Not applicable.

# **MSS405061A Determine and establish information collection requirements and processes**

## **Modification History**

New unit, superseding MSACMT661A Determine and establish information collection requirements and processes - Equivalent

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to determine what information is needed to support decision-making in a competitive systems and practices environment and then to set about establishing required information collection systems. This would usually be done as part of a team and would require consultation with all key stakeholders.

## **Application of the Unit**

This unit covers the determination of data needs and collection methods for an organisation or specific plant or process. This will typically be done in liaison with a wide range of people, each of whom will have their own specific information requirements. There will need to be balanced and interpreted into a workable set of data to be collected.

This unit is primarily focused on those decisions which are non-routine and so need specific collection of data, or for those decisions which are routine, the establishment of a routine data collection protocol to allow for the decisions to be made based on appropriate, reliable data.

This unit primarily requires the application of communication and problem solving skills associated with determining information requirements and processes of information collection. Initiative and enterprise, and planning and organising are also required to ensure information targets specific factors. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into the development of processes.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.



## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

- |   |  |     |  |
|---|--|-----|--|
| 1 | Analyse decisions to be made                   | 1.1 | Identify personnel to be included in the analysis process  |
|   |  | 1.2 | Determine the consequences of the decisions in liaison with relevant personnel   |
|   |  | 1.3 | Determine the variables which can be controlled  |
|   |  | 1.4 | Determine the variables which cannot be controlled   |
|   |  | 1.5 | Determine the consequences of a change in these variables in liaison with affected personnel                                     |
| 2 | Define factors which cause variables to change | 2.1 | Identify factors which are able to be controlled   |
|   |  | 2.2 | Identify factors which are not able to be controlled   |
|   |  | 2.3 | Identify means of measuring these factors, or indicators for the values of these factors   |
|   |  | 2.4 | Compile a list of measurements/indicators required.  |
|   |  | 2.5 | Communicate with team members and involve them in development of factors and changes to ensure awareness and facilitate learning |

3	Develop data collection protocols	3.1	Determine methods of making measurements
		3.2	Determine methods of quantifying indicators
		3.3	Determine the benefit/cost of automated (or other) collection of data
4	Develop systems to produce required information	4.1	Identify user of information and their needs and abilities
		4.2	Determine data processing needs to produce required information
		4.3	Determine information distribution channels
		4.4	Determine skill development need for recipients of information
		4.5	Implement systems to produce information
		4.6	Monitor implementation and make adjustments, as required

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating and negotiating at all levels in the organisation and value stream and with individuals of different levels of literacy and numeracy
- negotiating with employees, suppliers and customers, where necessary, to achieve access to, or collection of, data
- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in a wide variety of contexts
- developing or sourcing indicators for factors not easily measured
- liaising with stakeholders on acceptable limits for benefits and costs in data collection procedures

### Required knowledge

Required knowledge includes:

- business needs of the organisation/section
- information needs of individuals within the organisation
- possible data available/potentially available to the organisation
- methods of collecting available data
- relationship between data available and information required
- methods of converting data into useful information
- methods of developing indicators for factors resistant to measurement

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• determine relevant data, including variables for decisions</li><li>• determine factors and variables subject to control</li><li>• develop strategies for data collection that deliver the greatest overall benefit</li><li>• implement data collection systems.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li><li>• documentation and information in relation to production, waste, overheads and hazard control/management</li><li>• reports from supervisors/managers</li><li>• case studies and scenarios to assess responses to contingencies.</li></ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p>

	<p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"><li>• demonstration in the workplace</li><li>• workplace projects</li><li>• suitable simulation</li><li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li><li>• targeted questioning</li><li>• reports from supervisors, peers and colleagues (third-party reports)</li><li>• portfolio of evidence.</li></ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"><li>• lean operations</li><li>• agile operations</li><li>• preventative and predictive maintenance approaches</li><li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and</li></ul>
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	<p>proprietary systems</p> <ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Variables</b>	<p>Variables for this unit are:</p> <ul style="list-style-type: none"> <li>• measurable inputs, outputs or characteristic of processes or operations that have no fixed quantitative value.</li> </ul>
<b>Factors</b>	<p>Factors include:</p> <ul style="list-style-type: none"> <li>• any variable that is a part of, contributes to, or leads to the quantum of another variable. Ideally factors themselves should be able to be measured. However, in some operations there may be factors that are resistant to objective measurement (e.g. creativity in design, customer colour preferences and life cycles for new products). In these cases indicators for the value of these factors may need to be developed (e.g. through surveys, approximations or experiments)</li> </ul>
<b>Decision</b>	<p>A decision may include:</p> <ul style="list-style-type: none"> <li>• a change, improvement, new/altered process or system which requires data in order to monitor it or</li> </ul>

	where data is required to make a decision regarding the selection of alternatives
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## Unit Sector(s)

Unit sector Competitive systems and practices

## Custom Content Section

Not applicable.

# MSS405070A Develop and manage sustainable energy practices

## Modification History

New unit, superseding MSACMT670A Develop and manage sustainable energy practices - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to identify opportunities for, and make improvements in, sustainable energy practices in an organisation. Areas covered include efficient use of raw materials, management of waste, electricity conservation, heat conservation and management, water management, environment protection and environment obligations of enterprises.

## Application of the Unit

This unit applies to an individual who is required to establish systems for improved energy practices in an organisation. The unit involves analysis of energy used in processes and operations and categorising the energy use according to lean principles. The unit covers categorising energy into necessary use and waste with the waste being further categorised into necessary waste and unnecessary waste. Strategies for eliminating or minimising energy waste are covered with benefit/cost analyses being required for strategies.

This unit primarily requires the application of communication and problem solving skills associated with collecting and analysing information. An ability to analyse energy use of technology or processes will be applied. Initiative and enterprise, and planning and organising are also required to develop plans for efficient energy use. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into the development of processes.

Where the quantum of energy used is not easily available or a formal calculation of energy use is required through an energy balancing calculation (e.g. for regulatory purposes) the unit *MSS015011A Conduct a sustainability energy audit* may also be required.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse energy use	1.1	Identify all energy consuming processes
		1.2	Determine quantity and nature of energy consumed
		1.3	Analyse energy consumed and generated in different parts of the process
		1.4	Determine source of energy consumed in process
2	Develop energy conservation plans	2.1	Determine the efficiency of use of energy by all energy consuming processes
		2.2	Determine causes of low efficiency of use
		2.3	Develop plans for increasing the efficiency of energy use
		2.4	Determine benefit/cost of plans
3	Develop energy trading plans	3.1	Compare energy generating activities with energy consuming activities
		3.2	Determine feasibility of energy consuming activities using energy generated by other activities



		3.3	Develop plans for energy trading
		3.4	Determine benefit/cost of plans
4	Investigate alternative sources of energy	4.1	Develop a specification for energy required
		4.2	Identify a range of sources for that energy
		4.3	Determine benefit/cost for alternative energy sources
5	Develop plans for more efficient energy use	5.1	Compare benefit/costs for different alternatives developed
		5.2	Rank proposals based on benefit/cost compare to limited resources
		5.3	Check proposals meet regulatory requirements
		5.4	Recommend proposals for improving energy efficiency
6	Implement selected plans	6.1	Liaise with relevant people to implement energy efficiency plans
		6.2	Follow through to ensure implementation occurs
		6.3	Monitor implementation and make adjustments, as required
		6.4	Check new energy usage to ensure improvements have occurred

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- using common units, symbols and formulae common in energy-related calculations
- applying mathematics

- communicating with a variety of groups and individuals using different media
- solving complex problems individually and as part of a team
- reviewing range of existing data for suitability and determining where new data gathering is required
- planning and organising complex whole of organisation activities relating to energy use, including objectives, timelines, implementation procedures and monitoring strategy
- determining where energy balancing techniques are required
- accessing manufacturers' data and other sources of energy consumption for individual equipment and processes
- mapping processes and energy flows
- calculating, manipulating and interpreting numerical data
- ranking energy consumption and waste for area, sites or processes
- calculating the efficiency of use of energy by equipment and processes
- consulting with technical and operative staff on possible non-obvious energy wastes
- consulting and negotiating with stakeholders on implementation process for sustainability improvement

## Required knowledge

Required knowledge includes:

- types and sources of energy
- methods of analysing energy efficiency for different types of energy
- methods of converting energy values from one form to another
- alternative sources of energy
- principles of energy efficiency
- relevant regulatory/legislative requirements
- energy trading schemes and procedures
- organisation and process needs for energy

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"><li>• gather appropriate data to allow energy analyses</li><li>• categorise energy use into necessary use and waste</li><li>• develop options for energy reduction including</li></ul>
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	<p>presenting of alternatives and benefit/cost analyses</p> <ul style="list-style-type: none"> <li>• develop strategies and plans for energy use and monitor implementation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> </ul>
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	<ul style="list-style-type: none"> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Waste</b>	<p>Waste (also known as muda in the Toyota Production System and its derivatives) is any activity which does not contribute to customer benefit/features in the product.</p> <p>Within operations, categories of waste include:</p> <ul style="list-style-type: none"> <li>excess production and early production</li> <li>delays</li> <li>movement and transport</li> <li>poor process design</li> <li>inventory</li> <li>inefficient performance of a process</li> <li>making defective items</li> <li>activities which do not yield any benefit to the organisation or any benefit to the organisations customers</li> </ul>
<b>Necessary waste</b>	<p>Necessary waste is:</p> <ul style="list-style-type: none"> <li>any activity or cost which does not contribute directly to customer benefit/feature in the product, and which cannot be avoided (e.g. regulatory compliance and fixed costs). Necessary waste cannot be eliminated but should be managed</li> </ul>
<b>Unnecessary waste</b>	<p>Unnecessary waste is:</p> <ul style="list-style-type: none"> <li>any activity or cost which does not contribute directly to customer benefit/features in the product and can be avoided. Unnecessary waste should be eliminated as quickly as practical</li> </ul>
<b>Energy</b>	<p>Energy includes:</p> <ul style="list-style-type: none"> <li>all sources of energy used by the process be it electricity, gas or mobile transport fuel</li> </ul> <p>The uses of the energy will also be potentially wide and include:</p> <ul style="list-style-type: none"> <li>heating and cooling</li> <li>moving materials (e.g. pumps and conveyors)</li> <li>modifying materials (e.g. cutting, forming, weaving, knitting, reacting, moulding, extruding and mixing)</li> <li>generating pressure/vacuum or providing motive power for equipment and transport</li> </ul>
<b>Energy trading</b>	<p>Energy trading means both formal trading where the organisation investigates alternatives to:</p>

	<ul style="list-style-type: none"><li>• the buying of energy through alternative suppliers and tender processes</li><li>• selling of excess energy produced by the organisation to energy companies or other producers</li></ul> and <ul style="list-style-type: none"><li>• internal trading of excess energy from one area to an energy consuming area elsewhere in the organisation</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS405075A Facilitate the development of a new product

### Modification History

Release 2 - Content error in Range and Evidence Guide corrected. Prerequisite unit code corrected - MSS404052A

Release 1 - New unit, superseding MSACMT675A Facilitate the development of a new product\* - Equivalent

\* New prerequisite *MSS404052A Apply statistics to operational processes* superseding MSACMT452A Apply statistics to processes in manufacturing

### Unit Descriptor

This unit of competency covers the skills and knowledge required to facilitate the development of a new or evolutionary product within an existing range of products and encompasses design for manufacture, determining the process capability and the facilitation of its initial production.

### Application of the Unit

This competency applies to an individual responsible for the development of a new product. The unit assumes an initial product design has been prepared by a designer and also assumes a working knowledge of all main processes and materials so that an informed choice can be made between them. The person will normally be a manager or technical expert and be required to work closely with a range of other management and operations personnel.

The unit requires balancing the business and technical sides of the new product and would typically be done as part of a cross-functional team. This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Teamwork, problem solving, initiative and enterprise, and planning and organising are required to facilitate the development of a new product. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into competitive systems and practices.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

MSS404052A Apply statistics to operational processes

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Confirm design brief of new product in consultation with relevant people	1.1	Review product design with customer and other key stakeholders and agree on technical specification, aesthetic requirements, timelines, cost and other market requirements
		1.2	Determine any regulatory, industry code/intellectual property requirements for product
		1.3	Identify any required tooling, process or equipment needs
		1.4	Confirm design brief, including relevant drawings, to meet needs
		1.5	Determine design brief conforms to organisation objectives and capability
		1.6	Obtain approval on total design brief from all relevant personnel
2	Determine material requirements for product	2.1	Select appropriate materials or combination of materials/components in liaison with key stakeholders
		2.2	Determine material/component testing and evaluation regime required to meet product end use requirements,



- including regulatory/industry code requirements
- 2.3 Arrange for testing and evaluation of trial materials/components
- 2.4 Guide material trial process and interpret material trial results
- 2.5 Determine final materials/components specifications and details of value chain
- 3 Determine process requirements for product
  - 3.1 Select appropriate process to make product in liaison with key stakeholders and based on relevant factors
  - 3.2 Determine any special process/equipment requirements for this product
  - 3.3 Communicate with production personnel to determine any concerns and/or training or other needs
  - 3.4 Adjust the design, as required, to satisfy customer and production needs
- 4 Ensure process needs for new product have been met
  - 4.1 Liaise with equipment design/procurement personnel
  - 4.2 Interpret hardware specifications and ensure they are appropriate for the job required
  - 4.3 Liaise with process personnel to ensure appropriate draft procedures for new product have been developed
  - 4.4 Validate product cost and design meets organisation requirements and capability
- 5 Trial new product through the process
  - 5.1 Design trialing procedure to deliver required information
  - 5.2 Liaise with relevant stakeholders
  - 5.3 Ensure health safety and environment (HSE) requirements are observed
  - 5.4 Coordinate the trialling of the new product
  - 5.5 Interpret product trial results and guide product trial

		process
	5.6	Tune process to optimise production of new product
6	Determine process capability	6.1 Plot appropriate statistical process control charts
		6.2 Determine confidence limits
		6.3 Compare confidence limits with product specification
7	Coordinate product trials	7.1 Determine product testing and evaluation regime required to meet end use requirements, including regulatory/industry code requirements
		7.2 Arrange for testing and evaluation of trial product/prototype
		7.3 Interpret product trial results and guide product trial process
		7.4 Determine final product specification in liaison with key stakeholders
		7.5 Make required changes to materials, process and equipment
8	Implement standard procedures for new product	8.1 Monitor initial production and, in liaison with appropriate team members, adjust process, conditions and materials to ensure the product and process outcomes conform to customer, regulatory and organisation requirements
		8.2 Ensure process specifications are updated and reflect the optimised operation developed
		8.3 Ensure standard operating procedures are correct for the new product
		8.4 Ensure equipment and other hardware records are updated to reflect additions/changes
		8.5 Ensure project records are complete and all required reports have been completed and submitted

## 8.6 Archive records according to company procedure

### Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

#### Required skills

Required skills include:

- selecting and justifying the selection of:
  - type of material/material specification
  - appropriate process for a range of product/market applications
  - material and product testing procedures
- applying theoretical principles to predict:
  - properties of product based on materials selected
- identifying effects of processes and processing on the final properties of the product mathematically determine:
  - product cost estimates
  - process time
  - cost/benefit to organisation of new product
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- interpreting and making recommendations based on:
  - field test results
  - market analysis data
  - trialling data
  - organisation objectives and business plan
  - equipment and operations capacity

#### Required knowledge

Required knowledge includes:

- materials, equipment and process sufficient to choose an appropriate combination of materials and process to achieve the end use function of the product
- enterprise procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of their ability to:</p> <ul style="list-style-type: none"> <li>• ensure the development of a new product meets general organisation guidelines and objectives</li> <li>• liaise with the required people</li> <li>• optimise the process for the new product at the completion of the development phase</li> <li>• assess materials and components characteristics required in a design including material grades and properties and the effects of processing on materials and components</li> <li>• use trial outcomes to determine standard procedures for manufacture and/or operation of new product.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of</li> </ul>

	<p>contingencies, improvement scenarios, and so on)</p> <ul style="list-style-type: none"> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> </ul>
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	<ul style="list-style-type: none"> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Organisation objectives and requirements</b>	<p>Organisation objectives and requirements may include:</p> <ul style="list-style-type: none"> <li>• Board or management guidelines on: <ul style="list-style-type: none"> <li>• cost/profit requirements for new products (e.g. minimum return and capital expenditure limits)</li> <li>• encouragement/discouragement of different types of products (e.g. on sustainability, ethical or other non-individual customer related criteria)</li> </ul> </li> <li>• potential or actual capacity conflicts with other customers or product/process activities</li> <li>• activities that require/may require community consultation (e.g. on noise or other environmental grounds)</li> </ul>
<b>Tools and equipment</b>	<p>Tools and equipment may include:</p> <ul style="list-style-type: none"> <li>• understanding of use of all standard processing equipment</li> <li>• relevant personal protective equipment</li> </ul>
<b>Typical regulatory requirements</b>	<p>Typical regulatory requirements may include:</p> <ul style="list-style-type: none"> <li>• occupational health and safety (OHS)</li> <li>• environmental regulations</li> <li>• structural codes</li> <li>• product/industry specific requirements</li> </ul>
<b>Typical problems</b>	<p>Typical problems may include:</p> <ul style="list-style-type: none"> <li>• defining product end-use requirements in terms</li> </ul>

	<p>meaningful to the product design and manufacture</p> <ul style="list-style-type: none"><li>• matching suitable materials and processes to the product needs and company expertise and facilities</li><li>• matching (and improving) process capability to product tolerances</li></ul>
<b>Relevant factors</b>	<p>Relevant factors may include:</p> <ul style="list-style-type: none"><li>• type of material</li><li>• dimensional precision of product</li><li>• length of run/number of products</li><li>• required aesthetics</li><li>• size and complexity of product</li><li>• available capital funding</li><li>• process equipment available</li><li>• HSE factors</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405081A Develop a proactive maintenance strategy**

### **Modification History**

New unit, superseding MSACMT681A Develop a proactive maintenance strategy - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop and implement a proactive maintenance strategy for an organisation. The unit recognises that there are a number of predictive or proactive maintenance strategies, such as total productive maintenance (TPM) and reliability centred maintenance (RCM).

### **Application of the Unit**

This unit applies to an individual responsible for developing a proactive maintenance strategy for an organisation. Typically the organisation will also be implementing other competitive systems and practices. The unit applies to the selection of appropriate strategies, initial development and implementation as well as application of the strategies to new areas and the improvement of operation in existing areas. This would typically be done in a team environment and in consultation with all key stakeholders.

This unit primarily requires the application of skills associated with communication in gathering, analysing and applying information and consulting with stakeholders. Teamwork, problem solving, initiative and enterprise, and planning and organising are required to develop and implement a predictive maintenance strategy. Strategies will incorporate the maintenance requirements of relevant technologies. This unit also requires aspects of self-management and learning to ensure feedback and new learning is integrated into maintenance strategies.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.



## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Determine appropriate analytical techniques	1.1	Liaise with key stakeholders to determine objectives of maintenance strategy
		1.2	Examine current maintenance situation to determine major areas requiring improvement
		1.3	Compare possible strategies, techniques and tools against organisation needs
		1.4	Select possible strategies, techniques and tools
		1.5	Confirm selected strategies, techniques and tools with key stakeholders
2	Develop reliability strategies	2.1	Select preferred maintenance strategy
		2.2	Examine and adapt strategy to organisation needs and priorities
		2.3	Examine and adapt techniques and tools required to implement strategy
		2.4	Liaise with key stakeholders to develop an implementation plan
		2.5	Identify key information and performance indicators required
3	Implement strategy	3.1	Identify data collection required
		3.2	Identify hardware and other resources required

- |   |                                    |   |
|---|------------------------------------|---|
|   | 3.3                                | Identify skill needs required in consultation with key stakeholders |
|   | 3.4                                | Ensure all resources/training are available                         |
|   | 3.5                                | Implement strategy  |
| 4 | Monitor implementation of strategy |   |
|   | 4.1                                | Compare information/performance indicators with desired levels      |
|   | 4.2                                | Liaise with key stakeholders regarding strategy issues              |
|   | 4.3                                | Identify areas requiring adjustment                                 |
|   | 4.4                                | Make required adjustments   |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- communicating with others using a variety of media and techniques
- adapting personal communication strategy to different levels of literacy and numeracy in target individuals and groups
- working in a team
- analysing quantitative and qualitative information to determine proactive maintenance strategy options
- solving problems to root cause
- applying basic arithmetic and statistical techniques
- planning complex strategies, including consideration of timelines, resources, benefit/cost, implementation requirements, and monitoring and adjustment considerations
- reading and interpreting engineering specifications, drawings and charts
- using information system terminals and computers
- prioritising options, including reasons and recommendations
- recording data

### Required knowledge

Required knowledge includes:

- characteristics and strengths of different types of strategies, techniques and tools, such as:
  - TPM
  - RCM
  - mean time between failure (MTBF)
  - failure mode effects analysis (FMEA)
  - condition monitoring
  - root cause analysis (RCA)
- holistic costs of different strategies combining cost of maintenance with costs of lost production, sales, and so on, as relevant to the organisation
- business goals sufficient to match the strategy to the business needs
- strategic thinking and its application to proactive maintenance
- principles of process equipment and how to improve its reliability
- resources required and how to obtain them

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• consider a variety of proactive maintenance strategies for suitability to an organisation</li> <li>• consult operators, maintenance, management and other stakeholders in decisions on proactive maintenance strategies</li> <li>• implement selected strategies</li> <li>• monitor performance to selected indicators and make improvements to selected proactive maintenance strategies.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented</li> </ul>

	<p>changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning for appropriate portions</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>OEE</b>	<p>OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is:</p> $OEE = \text{availability} \times \text{performance} \times \text{quality rate}$ <p>where:</p> <ul style="list-style-type: none"> <li>• availability takes into account losses due to breakdown, set-up and adjustments</li> <li>• performance takes into account losses due to minor</li> </ul>

	<p>stoppages, reduced speed and idling</p> <ul style="list-style-type: none"> <li>quality rate takes into account losses due to rejects, reworks and start-up waste</li> </ul>
<b>MTBF</b>	<p>MTBF is one key measure of the effectiveness of a maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MTBF is reducing, then it is an indicator that the maintenance regime is failing.</p> <p>There are many possible causes of any problem. Eliminating some will have no impact, others will ameliorate the problem. However, elimination of the root cause will eliminate the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem.</p> <p>Depending on the equipment, operations and procedures of the organisation, alternative statistical records of maintenance and maintenance-related events may be substituted for MTBF providing they relate strategies for improving OEE.</p>
<b>FMEA</b>	<p>FMEA is a systematic approach that identifies potential failure modes in a system, product, or operations/assembly operation caused by either design or operations/assembly process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring.</p> <p>Some industry sectors have highly adapted forms of FMEA and may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification.</p> <p>HAZOP is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to process stability.</p>
<b>Condition monitoring</b>	<p>Condition monitoring is used to describe the process of analysing the implications of condition monitoring data for proactive maintenance whether it be obtained from non destructive testing (NDT) reports, visual assessment by experts, diagnostic reports obtained from SCADA or other enterprise or equipment software and product or process quality analyses. It does not require the actual</p>

	undertaking of the NDT or condition monitoring assessment or test. If this is required appropriate units from other Training Packages will be required.
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS405083A Adapt a proactive maintenance strategy for a seasonal or cyclical business**

### **Modification History**

New unit, superseding MSACMT683A Adapt a proactive maintenance strategy for a seasonal or cyclical manufacturing operation\* - Equivalent

\* New prerequisite *MSS405081A Develop a proactive maintenance strategy* superseding MSACMT681A Develop a proactive maintenance strategy

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop a standard proactive maintenance strategy for a seasonal or cyclical operational processes or similar.

### **Application of the Unit**

This unit applies to an individual responsible for developing a proactive maintenance strategy for an organisation that operates seasonal/cyclical plant and also adopts proactive maintenance strategies. The organisation will also usually be implementing other competitive systems and practices. Typical applications include many food processing enterprises, cotton ginning, sugar refineries, and so on. The unit covers changing the normal priority of some of the choices which need to be made in implementing a proactive maintenance strategy. The unit applies to the selection of appropriate strategies, initial development and implementation will need to be managed as well as application of the strategies to new areas and the improvement of operation in existing areas.

This would typically be done in a team environment and in consultation with all key stakeholders.

This unit requires the application of skills associated with problem solving, initiative, enterprise, planning and organising in order to adapt a proactive maintenance strategy to meet seasonal or cyclical needs of the enterprise. This work is done in the context of using computer technology and also requires aspects of self-management and learning to ensure improvement of own performance.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

MSS405081A Develop a proactive maintenance strategy



## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Interpret proactive maintenance strategy	1.1	Analyse proactive maintenance strategy
		1.2	Identify areas which may conflict with cyclical requirements
		1.3	Identify critical conditions which must be met in order to maintain plant reliability until season end
		1.4	Compile cycle requirements for proactive maintenance strategy
2	Identify cyclical requirements of the process	2.1	Establish when the season finishes and the expected cycle duration
		2.2	Identify plant items and maintenance activities which production imperatives dictate can only be completed after season end
		2.3	Identify critical conditions which must be met in order to maintain plant reliability until season end
		2.4	Compile cycle requirements for proactive maintenance strategy

3	Identify maintenance requirements of ancillary equipment	3.1	Identify proactive maintenance requirements of ancillary equipment
		3.2	Identify maintenance which can only be done at season end
		3.3	Compile ancillary equipment requirements for proactive maintenance strategy
4	Identify maintenance requirements during season	4.1	Identify critical maintenance activities which must be done during season
		4.2	Negotiate conflicts with seasonal or cyclical processing requirements
		4.3	Compile proactive maintenance strategy requirements during season
5	Adapt proactive maintenance strategy	5.1	Compare identified requirements to the proactive maintenance strategy
		5.2	Negotiate a proactive maintenance strategy which meets these requirements
		5.3	Involve team members in relating identified problems and opportunities for improvement to the maintenance strategy, and involve them in developing any required changes to ensure awareness, learning and commitment
		5.4	Monitor the implementation of the strategy to ensure the identified requirements are met
		5.5	Make required adjustments and arrange review schedule

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- considering the impact of seasonal and cyclical production requirements on equipment

availability requirements

- prioritising maintenance activities critical to production
- communicating with others using a variety of media and techniques
- adapting personal communication strategy to different levels of literacy and numeracy in target individuals and groups
- working in a team
- analysing quantitative and qualitative information to determine proactive maintenance strategy options
- solving problems to root cause
- applying basic arithmetic and statistical techniques
- planning complex strategies, including consideration of timelines, resources, benefit/cost, implementation requirements, and monitoring and adjustment considerations
- reading and interpreting engineering specifications, drawings and charts
- using information system terminals and computers
- prioritising options, including reasons and recommendations
- recording data

## Required knowledge

Required knowledge includes:

- processing equipment and products of the organisation
- start-up, shutdown and isolation considerations for the organisation
- skills required by operators and maintenance personnel to achieve effective proactive maintenance strategy implementation
- characteristics and strengths of different types of strategies, techniques and tools, such as:
  - total productive maintenance (TPM)
  - reliability centred maintenance (RCM)
  - mean time between failure (MTBF)
  - failure mode effects analysis (FMEA)
  - condition monitoring
  - root cause analysis (RCA)
- holistic costs of different strategies combining cost of maintenance with costs of lost production, sales, and so on, as relevant to the organisation
- business goals sufficient to match the strategy to the business needs
- strategic thinking and its application to proactive maintenance
- principles of process equipment and how to improve its reliability
- resources required and how to obtain them

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse the equipment availability requirements of a seasonal or cyclical operation</li> <li>• consider a variety of proactive maintenance strategies for suitability to a seasonal or cyclical operation</li> <li>• consult operators, maintenance, management and other stakeholders in decisions on proactive maintenance strategies</li> <li>• monitor the implementation of selected proactive maintenance strategies and make required adjustments.</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<p><b>Method of assessment</b></p>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues</li> </ul>

	<p>(third-party reports)</p> <ul style="list-style-type: none"> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> </ul>
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	<ul style="list-style-type: none"> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Critical conditions</b>	<p>Critical conditions are those factors which must be undertaken or determined in order to maintain plant reliability during processing season. These may include:</p> <ul style="list-style-type: none"> <li>• maximum load factors</li> <li>• lubrication schedules</li> <li>• correct operating temperatures</li> <li>• cleaning and waste removal schedules</li> <li>• equipment inspection and test schedules</li> <li>• development of standard operating procedures and training of operators</li> </ul>
<b>Ancillary equipment</b>	<p>Ancillary equipment includes other plant, such as:</p> <ul style="list-style-type: none"> <li>• boilers</li> <li>• utilities</li> <li>• plants</li> <li>• waste treatment and hazard control equipment (e.g. fire ring mains, fire monitors, steam curtains, gas (or other loss of containment) monitors, blast protection and flare stacks)</li> </ul>
<b>TPM</b>	<p>TPM refers to:</p> <ul style="list-style-type: none"> <li>• an application of total quality management to maintenance with the intention of increasing reliability, getting it right first time and increasing OEE</li> </ul>
<b>RCM</b>	<p>RCM includes:</p> <ul style="list-style-type: none"> <li>• moving maintenance from reactive, or even planned/programmed towards a focus on uptime and</li> </ul>

	OEE
<b>RCA</b>	RCA is a structured problem solving technique. Typically there are many possible causes of any problem. Eliminating some will have no impact, others will ameliorate the problem. However, elimination of the root cause will eliminate the problem. There should only be one root cause for any problem and so the analysis should continue until this one cause is found. Elimination of the root cause permanently eliminates the problem.
<b>MBTF</b>	MBTF is one key measure of the effectiveness of a maintenance procedure, and is an indicator as to whether root causes are being found and resolved. If MBTF is reducing, then it is an indicator that the maintenance regime is failing.
<b>FMEA</b>	FMEA is a systematic approach that identifies potential failure modes in a system, product, or operations/assembly operation caused by either design or operations/assembly process deficiencies. It also identifies critical or significant design or process characteristics that require special controls to prevent or detect failure modes. FMEA is a tool used to prevent problems from occurring. Some industry sectors have highly adapted forms of FMEA and may practice traditional FMEA in say their routine maintenance while using another technique, such as Hazard and Operability Studies (HAZOP) for design and modification.
<b>Uptime</b>	Uptime refers to: <ul style="list-style-type: none"> <li>the overall availability of the plant (it is the inverse of downtime) or the unavailability of the plant. Ideal uptime is 100%</li> </ul>
<b>OEE</b>	OEE is the combination of the main factors causing loss of productive capacity from equipment/plant and is where: $OEE = availability \times performance \times quality\ rate$ <ul style="list-style-type: none"> <li>availability takes into account losses due to breakdown, set-up and adjustments</li> <li>performance takes into account losses due to minor stoppages, reduced speed and idling</li> <li>quality rate takes into account losses due to rejects, reworks and start-up waste</li> </ul>
<b>Condition monitoring</b>	Condition monitoring involves often quite sophisticated monitoring of equipment, including such things as:

	<ul style="list-style-type: none"><li>• vibration monitoring</li><li>• instrumental analysis of lubricating oil, and so on, to determine the current state of the equipment, monitor the change in this condition and predict when it needs servicing/maintenance to maintain reliability</li></ul>
<b>HAZOP</b>	HAZOP is a form of FMEA which has been practiced by the process industries for over 30 years and examines the implications of changes in process conditions to process stability.

## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.



## **MSS407001A Prepare for and implement change**

### **Modification History**

New unit, superseding MSACMG701A Prepare for and implement change - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to establish the preconditions for the implementation of a change, such as a 'step change' or a change resulting from a problem solving exercise, such as a kaizen blitz. The unit can be applied to subsections of an organisation, such as a team, area or department, or a small or medium sized enterprise (SME).

### **Application of the Unit**

This unit is intended for team leaders and people with a similar sphere of influence/scope of authority and responsibility. It applies to individuals who are already familiar with change leadership in a competitive systems and practices environment through either previous study or industry experience. Where this is not the case, MSS403010A Facilitate change in an organisation implementing competitive systems and practices, may be completed to supply the necessary skills.

Skills covered by this unit are applied in an organisation after a desired change has already been identified. This unit may also be applied in service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Define the change   | 1.1 Determine the purpose of the change<br>1.2 Identify key change project personnel<br>1.3 Record the current state that the change is addressing<br>1.4 Develop a consensus view of the intended future state, including indicators of a successful change<br>1.5 Develop an agreed statement of the solution<br>1.6 Identify the health, safety and environment (HSE) impacts of the change<br>1.7 Determine the scope of the change project, including taking into account the impact of the solution on any codes of practice, standards, contracts, commercial or industrial agreements<br>1.8 Obtain sign-off from key change project personnel |
| 2 | Identify personnel required to implement the change and their roles | 2.1 Develop a high level change network map<br>2.2 Identify employees, suppliers or customers who may be required to implement the change<br>2.3 Identify other demands on these people during the change<br>2.4 Investigate priorities, synergies and conflicts<br>2.5 Take appropriate action to resolve conflicts   |
| 3 | Assess and manage the   | 3.1 Identify organisational capacity for the change, including available resources and ability to absorb any   |

change-related risks		disruption during the change	
		3.2	Clarify specific risk dimensions for this change
		3.3	Develop appropriate transition approach
4	Build high level change plans	4.1	Develop high level involvement plan
		4.2	Develop high level communication plan to all stakeholders
		4.3	Develop high level competency development plan for all implementers
		4.4	Develop high level alignment plan
5	Implement and sustain the change	5.1	Implement change plans
		5.2	Check change objectives have been met
		5.3	Transfer ownership of post-change operations from change agents, where relevant
		5.4	Ensure support structures are in place
		5.5	Check alignments have been obtained
		5.6	Check competencies have been developed and will be maintained
		5.7	Ensure base line is defined for continuous improvement
		5.8	Review project and capture learning from the project
		5.9	Take action to sustain improvement by standardising

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation
- presenting to others the benefits of change
- initiating, planning and executing change across broad and specialised contexts
- developing strategies to counter resistance to change
- adjusting change strategies on the basis of review findings and feedback

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators (KPIs)/metrics
  - identification and elimination of waste (muda)
- change management
- workplace strategy and vision
- methods of determining competency gaps in team members
- project planning and management

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• prepare for and deliver change</li><li>• communicate with all stakeholders</li><li>• develop consensus among stakeholders</li><li>• undertake risk analysis of proposed changes</li><li>• develop and implement of change management plans that have objectives, measurable KPIS and tested solutions to anticipated contingencies.</li></ul>
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<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Change project personnel</b>	<p>Change project personnel include:</p>

	<ul style="list-style-type: none"> <li>the decision makers who determine if the proposed change may proceed and the key managers and implementers of the change</li> </ul>
<b>Current state</b>	The current state is ideally defined by existing data. Where this is not available suitable proxies should be sought
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented should be at least neutral, or preferably beneficial, in their impact on HSE
<b>High level change network</b>	<p>High level change network includes groups involved in the change and who need to be committed to the change and include:</p> <ul style="list-style-type: none"> <li>sponsors</li> <li>cascading change sponsors</li> <li>targets</li> <li>agents</li> <li>advocates</li> <li>enablers</li> <li>impeders</li> </ul>
<ul style="list-style-type: none"> <li><b>Organisation</b></li> </ul>	<p>Organisation includes:</p> <ul style="list-style-type: none"> <li>any part of a manufacturing or service organisation</li> <li>companies, government bodies or other body of people aiming to produce a product to service a customer</li> </ul>
<b>Key change project personnel</b>	<p>Key change project personnel include:</p> <ul style="list-style-type: none"> <li>project sponsors</li> <li>cascading sponsors</li> <li>relevant managers</li> <li>change agents</li> </ul>
<ul style="list-style-type: none"> <li><b>Project sponsor</b></li> </ul>	<p>Project sponsors include:</p> <ul style="list-style-type: none"> <li>those people who proposed the project and are its main supporters</li> </ul>
<ul style="list-style-type: none"> <li><b>Cascading sponsor</b></li> </ul>	<p>A cascading sponsor refers to:</p> <p>a person who reports to a sponsor and so may be contributing on their behalf</p> <p>A cascading sponsor works with delegated authority and</p>

	responsibility
<b>Risks</b>	<p>Risks include:</p> <ul style="list-style-type: none"> <li>• business risks (e.g. over-spending)</li> <li>• market risk (e.g. loss of market share)</li> <li>• HSE risks</li> <li>• relationship risks (e.g. to shareholders, employees, suppliers, customers or the community)</li> </ul>
• <b>Organisation capacity</b>	<p>Organisation capacity includes:</p> <ul style="list-style-type: none"> <li>• organisation history of implementing change</li> <li>• capability in change implementation</li> <li>• adaptability of people to change</li> <li>• demand for the change in the part of the organisation</li> </ul>
• <b>Risk dimensions</b>	<p>Specific risk dimensions include:</p> <ul style="list-style-type: none"> <li>• impact of the solution (its potential for disruption to production, quality, delivery and budgets)</li> <li>• readiness of people to accept the change, including readiness to accept changes in role and responsibilities</li> <li>• availability of resources, including financial, plant and equipment, and dedicated personnel</li> </ul>
• <b>Transition approach</b>	<p>Transition approach will depend on the nature of the risks determined and will include:</p> <ul style="list-style-type: none"> <li>• transition style (top down/pilot/process focused/delegated change)</li> <li>• degree of sponsorship to be cascaded</li> <li>• balance of engagement/involvement</li> <li>• internal and/or external resources</li> <li>• use of change to build organisation capacity</li> </ul>
• <b>High level involvement plans</b>	<p>High level involvement plans aim to create ownership by involving groups in specific activities within defined constraints of:</p> <ul style="list-style-type: none"> <li>• objectives for involvement</li> <li>• decision parameters and</li> <li>• timing of involvement</li> </ul> <p>The specific activities include:</p> <ul style="list-style-type: none"> <li>• problem/opportunity identification</li> <li>• solution design</li> <li>• implementation/transition planning</li> <li>• solution building</li> </ul>



	<ul style="list-style-type: none"> <li>• solution testing</li> <li>• solution piloting</li> <li>• training design</li> <li>• training delivery</li> <li>• communication roll out</li> <li>• solution roll out</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Alignment plan</b></li> </ul>	<p>Alignment plan ensures alignment and sustainability between:</p> <ul style="list-style-type: none"> <li>• policies, processes and procedures</li> <li>• incentives and rewards (KPIs and intended outcomes)</li> <li>• consequences and penalties for non-compliance</li> <li>• preventing pre-change behaviours and patterns recurring</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Sustaining improvement</b></li> </ul>	<p>Improvement may be sustained by including it in:</p> <ul style="list-style-type: none"> <li>• standard procedures and work instructions</li> <li>• standard practice</li> <li>• other relevant documents and practices</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Team leader</b></li> </ul>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407002A Review operations practice tools and techniques**

### **Modification History**

New unit, superseding MSACMG702A Review manufacturing practice tools and techniques - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to apply continuous improvement to the use of competitive systems and practices tools and techniques, that is, facilitating the right use of the right tool at the right time and reviewing its application.

### **Application of the Unit**

This unit is intended for team leaders and people with a similar sphere of influence and scope of authority and responsibility. It covers the reviewing of competitive tools used by an organisation which has already embarked on a competitive systems and practices path and is driven by the pull of its customers.

The unit includes checking that the relevant competitive systems and practices practice tools are being consistently and correctly applied across the entire organisation to enhance customer and organisation value. It also includes reviewing the processes used to identify when additional or different competitive systems and practices tools should be applied.

This unit applies to individuals who have a broad knowledge of all major competitive tools with in-depth application knowledge of several tools which are relevant to the organisation and familiarity with a define, measure, analyse, improve, control (DMAIC) approach.

This unit may also be applied to service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Review the use of competitive systems and practices tools	1.1	Identify which competitive tools are being used in the work area
		1.2	Define the outcomes expected from each tool
		1.3	Observe and measure the actual outcomes being achieved
		1.4	Identify gaps between actual outcomes and planned outcomes
		1.5	Determine if the tools are being used as intended
		1.6	Review tool use and determine if the most appropriate tool is being used
		1.7	Audit health, safety and environment (HSE) impacts from the use of tools
		1.8	Identify any system/process issues impeding the tools delivering their expected outcomes
		1.9	Identify any gaps between tool capability and customer benefit requirements
2	Recommend changes to the use of competitive systems and	2.1	Define required further improvements identified
		2.2	Prioritise required further improvements
		2.3	Identify gaps inhibiting tool use

practices tools	2.4	Recommend system and process changes, as required, to improve tool use
	2.5	Recommend alternative or additional tools, as required, to achieve organisation requirements
	2.6	Obtain required authorisations for changes
3 Facilitate the better use of competitive systems and practices tools	3.1	Facilitate training or other resources needed, as required, to improve tool use
	3.2	Facilitate system and process changes, as required, to improve tool use
	3.3	Facilitate the introduction and use of new tools, as required
	3.4	Initiate procedures for sustaining the changes

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing organisation processes and products and match to appropriate competitive systems and practices tools
- undertaking self-directed problem solving and decision-making
- analysing current state/situation
- defining improvement outcomes expected in own area of responsibility from the implementation of competitive systems and practices tools
- communicating across all levels in an organisation
- analysing occupational health and safety (OHS) impacts from implementation of competitive systems and practices tools
- preparing reports and recommendations in regards to implementation of competitive systems and practices tools
- measuring improvement outcomes

### Required knowledge

Required knowledge includes:

- competitive systems and practices tools, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators/metrics
- identification and elimination of waste (muda) organisation processes and products applications and limitations of different competitive systems and practices tools
- typical benefits for customers from implementation of competitive systems and practices tools
- DMAIC process applied to competitive systems and practices tool use
- approvals and delegations within the organisation
- procedures, including processes for updating and drafting of procedures

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• critically review the use of competitive tools</li> <li>• take a DMAIC approach</li> <li>• compare actual outcomes to planned outcomes</li> <li>• discriminate between the causes of suboptimal performance</li> <li>• recommend appropriate changes to tools used, tool usage and/or tool implementation.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned,</li> </ul>

	<p>currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Review tool use</b>	<p>Review of tool use includes:</p> <ul style="list-style-type: none"> <li>• identifying whether a better tool could have been used and whether there is an appropriate balance between daily continuous improvement and kaizen blitz</li> </ul>
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used</p>

<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Outcomes</b>	Outcomes include: <ul style="list-style-type: none"> <li>the benefits both to the organisation and also the customers</li> </ul>
<b>Define improvements</b>	The definition of improvements may include: <ul style="list-style-type: none"> <li>a specification of the problem/capability gap being addressed</li> <li>a specification of how that problem/gap will be solved/filled</li> <li>a statement of the intended benefits of the solution</li> <li>a statement of the indicators of progress and success</li> </ul>
<b>DMAIC approach</b>	DMAIC is an approach to improving an existing business process to reduce defects. It stands for: <ul style="list-style-type: none"> <li>define</li> <li>measure</li> <li>analyse</li> <li>improve</li> <li>control</li> </ul>
<b>Organisation</b>	Organisation includes: <ul style="list-style-type: none"> <li>any part of a operations or service organisation</li> <li>companies, government bodies or other body of people aiming to produce a product to service a customer</li> </ul>
<b>Team leader</b>	Team leader may include: <ul style="list-style-type: none"> <li>any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>
<b>Gaps inhibiting tool use</b>	Gaps inhibiting tool use may include: <ul style="list-style-type: none"> <li>competency gap of employees in own or other value stream organisation</li> <li>lack of management or employee support</li> <li>lack of financial or other resources</li> <li>inadequate data</li> </ul>
• <b>Sustaining improvement</b>	Improvement may be sustained by including it in: <ul style="list-style-type: none"> <li>standard procedures and work instructions</li> <li>standard practice</li> <li>other relevant documents and practices</li> </ul>



## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS407003A Analyse process changes

### Modification History

New unit, superseding MSACMG703A Analyse process changes - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to quantitatively analyse past changes made in an organisation's the operations, systems, process or environment to ensure the quantum of expected change has been achieved and that gains are maintained and are used as a basis for further gains.

The unit includes statistical and other mathematical analysis of data, methods for capturing data on implemented changes (quantitative and qualitative) and producing useful information from this data. It includes consultation with stakeholders both for data validation and consensus decision-making for future improvements.

### Application of the Unit

This unit applies to team leaders, technical experts and people with a similar sphere of influence/scope of authority and responsibility who are already have a knowledge of statistics used in managing operations and of process capability improvement and some knowledge of factorial design, the selection and analysis of appropriate metrics, and the discrimination between valid and invalid interpretations of data. Where this is not the case *MSS404050A Undertake process capability improvements* and *MSS404052A Apply statistics to operational processes* may be completed to supply the necessary statistical skills.

If this unit is being applied to a complex change process or a complex operations process, it may be an advantage to have completed *MSS405052A Design an experiment* before completing this unit. Where this unit is being applied in a six sigma environment then knowledge and skill in six sigma techniques may also be an advantage. *MSS405053A Manage application of six sigma for process control and improvement* can be completed to supply these skills.

The unit applies to reviews of both intended and unintended consequences of change and the effectiveness of the implementation of the change. This unit is not intended to be applied to a technical or engineering review of a major capital expenditure or similar.

This unit takes a largely quantitative approach to the review. For skills associated with a more qualitative review refer to *MSS407005A Undertake a qualitative review of a process change*.

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                  |     |   |
|---|------------------|-----|---|
| 1 | Analyse a change | 1.1 | Identify changes which have occurred  |
|   |                  | 1.2 | Select a change or group of related changes to analyse  |
|   |                  | 1.3 | Determine the initiation of the selected change   |
|   |                  | 1.4 | Identify relevant metrics and predicted values for these metrics                                      |
|   |                  | 1.5 | Gather data for these metrics prior to the change   |
|   |                  | 1.6 | Gather data and information on the implementation of the change                                       |
|   |                  | 1.7 | Gather data for these metrics after the change  |
|   |                  | 1.8 | Survey all key metrics and identify any where variations may correlate with the change being analysed |
|   |                  | 1.9 | Discuss results of change with key stakeholders and   |

- identify other possible (qualitative or quantitative) results of the change
- 1.10 Analyse this data to determine the results of the change
- 2 Review results of change with stakeholders
- 2.1 Identify trends over time in all relevant metrics
- 2.2 Analyse correlated metrics to determine causal relationship
- 2.3 Audit health, safety and environment (HSE) impacts as a result of the change
- 2.4 Present information in a form understandable by stakeholders
- 2.5 Discuss analysed information with relevant stakeholders
- 2.6 Modify information based on stakeholder input, as required
- 2.7 Develop a consensus view of the result of the change which is supported by the information available
- 2.8 Validate the consensus view with stakeholders
- 3 Identify future improvements
- 3.1 Discuss lessons learned from the change with stakeholders
- 3.2 Capture key knowledge in accordance with systems and procedures
- 3.3 Identify future improvements in collaboration with team members
- 3.4 Validate identified changes with stakeholders
- 3.5 Obtain sign off from process/system owner
- 3.6 Start the process for implementing future improvements
- 3.7 Check that the planned improvements are occurring
- 3.8 Take action to sustain improvement by standardising

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- researching past performance of plant, operations, products and procedures, including metrics used
- identifying trends, causal relationships and correlations in metrics
- communicating and explaining quantitative data with others across a range of numeracy and literacy levels
- analysing views and reasons put forward by others on past performance and relating to evidence
- analysing views and reasons put forward by others for future changes and improvements and form recommendations
- identifying key HSE strategies and risks for area of responsibility and identifying sources of expert assistance
- preparing submissions and presenting case for future changes

### Required knowledge

Required knowledge includes:

- competitive systems and practices principles, processes and techniques
- organisational goals, products and processes
- processes and procedures for continuous improvement in the workplace
- statistical process control (SPC) and principles
- methods of determining the impact of a change using quantitative analysis of process data, including advanced statistical/mathematical analysis and basic qualitative techniques
- organisation metrics
- sources of data (actual and possible) within the organisation and the value stream
- range of typical metrics, their applications and limitations

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

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## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse process changes</li> <li>• identify changes</li> <li>• gather data and information over a period and range that will provide a valid basis for analysis</li> <li>• select and use appropriate data analysis tools</li> <li>• present information in a suitable form</li> <li>• obtain a consensus view of the results of the change</li> <li>• determine the lessons to be learned and future improvements to be undertaken.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess</p>

	<p>underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

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	<ul style="list-style-type: none"> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where changes include areas covered by industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>Gather prior data</b>	Where all suitable data was not collected prior to the change a suitable proxy for the data will be needed
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Change</b>	<p>Changes may:</p> <ul style="list-style-type: none"> <li>• be to plant, operations, products, procedures or practice</li> <li>• arise from continuous improvement (or an improvement event/project) or implementing new products, technology or systems</li> <li>• may have been intended to make an improvement or to implement new products, technology or systems</li> <li>• include the implementation of a change</li> </ul> <p>Changes do not include an engineering review of a major capital expenditure or similar review</p>
<b>Initiation of change</b>	Changes need to be identified as either deliberately or not deliberately initiated. Where a change was not deliberately initiated then the causal factors for the change need to be identified
<b>Correlated metrics</b>	<p>Correlated metrics include:</p> <ul style="list-style-type: none"> <li>• any metric which appears to show a chronological correlation with the change being analysed. These metrics need to be examined to determine if the change has a causal relationship or is simply coincidental</li> </ul>
<b>Presentation of information</b>	Information may be presented:



	<ul style="list-style-type: none"> <li>• in appropriate visual forms (e.g. graphs, charts and noticeboards)</li> <li>• verbally or other forms able to be understood and used by stakeholders</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• work team members</li> <li>• value stream members</li> <li>• managers</li> </ul>
<b>Results of change</b>	<p>The change results may include:</p> <ul style="list-style-type: none"> <li>• an initial improvement followed by a return to previous performance</li> <li>• continued improvement</li> <li>• continued detriment or other variations over time</li> </ul>
<b>Improvements</b>	<p>Improvements may:</p> <ul style="list-style-type: none"> <li>• be to operations, process, plant, procedures or practice</li> <li>• include changes to ensure positive benefits are maintained</li> </ul>
<b>Sustaining improvement</b>	<p>Improvement may be sustained by including it in:</p> <ul style="list-style-type: none"> <li>• standard procedures and work instructions</li> <li>• standard practice</li> <li>• other relevant documents and practices</li> </ul>
<b>Team leader</b>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS407004A Facilitate improvements in the internal value stream

### Modification History

New unit, superseding MSACMG704A Facilitate improvements in the internal value chain - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to deal with internal value stream members in order to improve the overall effectiveness of the value stream, so delivering greater value to the customer. This unit applies to improvement practices which a person might have used within their own team or work area to other teams or work areas within the value stream and covers areas where value stream issues impact on the overall ability of the organisation to continue to improve and offer better value to the customers.

### Application of the Unit

This unit applies to team leaders or people in equivalent positions who have contact with internal value stream members outside their own team and who are already familiar with competitive systems and practices, formal problem solving and root cause analysis, leading change, and reducing costs. Where this is not the case the following units can be completed to supply the necessary skills:

- MSS402080A Undertake root cause analysis
- *MSS403001A Implement competitive systems and practices*
- *MSS403011A Facilitate implementation of competitive systems and practices*
- *MSS403030A Improve cost factors in work practices.*

The unit applies to 'gate-to-gate' value streams. For skills associated with a source to destination value streams refer to *MSS407009A Facilitate improvements in the external value stream*.

This unit does not apply to mapping or managing value streams (refer to *MSS405002A Analyse and map a value stream* and *MSS405003A Manage a value stream*). Where previous improvements need to be evaluated refer to *MSS407005A Undertake a qualitative review of a process change* and *MSS407003A Analyse process changes*.

This unit may also be applied to service organisations applying competitive systems and practices principles

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify opportunities for continued improvement	1.1	Identify past improvements which have been implemented but have not delivered intended benefits
		1.2	Identify suggested improvements which have not yet been implemented
		1.3	Discuss and identify with team members new improvement opportunities
		1.4	Determine which of these improvements have been or may be restricted by other value stream members
		1.5	Suggest possible factors causing this restriction
		1.6	Select possible improvements for further study
2	Study restrictions to further improvement with value stream	2.1	Arrange meeting with suitable representatives of the value stream member
		2.2	Outline the opportunities for improvement and any

	member		current or anticipated restrictions
		2.3	Work with value stream representatives to determine root cause of restrictions
		2.4	Work with value stream member to identify possible solutions to problem
		2.5	Define outcomes from any proposed changes
3	Develop a consensus approach to implementing improvements	3.1	Determine benefits/costs to value stream member from the proposed changes
		3.2	Determine benefits/costs to own process from the proposed changes
		3.3	Decide whether the proposed improvements will result in an valuable improvement to the end customer
		3.4	Determine health, safety and environment (HSE) impacts as a result of the change
		3.5	Agree on proposed change/program of changes with all key stakeholders
4	Obtain required approvals	4.1	Draft a formal proposal for the proposed changes
		4.2	Submit proposal for all required approvals from stakeholders
		4.3	Modify proposal, as required, in liaison with all key stakeholders
		4.4	Obtain sign-off from process/system owner
5	Measure and communicate gains	5.1	Agree indicators/metrics of success of proposed changes
		5.2	Make arrangements to collect the necessary data
		5.3	Make arrangements for the data to be analysed and presented in an agreed format to the agreed stakeholders
		5.4	Agree the communication plan

- 5.5 Liaise with stakeholders to implement changes as agreed and approved
- 6 Review change
  - 6.1 Analyse results of change
  - 6.2 Identify areas which have not met predicted outcome (positive or negative)
  - 6.3 Determine cause of target not being met
  - 6.4 Take appropriate action to improve the value stream
  - 6.5 Take action to sustain improvement by standardising

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing proposed and past changes to operations, products and processes within own team and the internal value stream to determine if change adds or has added value to the customer
- making significant, high level, independent judgements on required improvements in the internal value stream
- demonstrating responsibility and broad-ranging accountability for decisions
- communicating and explaining quantitative and qualitative concepts and data with others across a range of numeracy and literacy levels
- analysing views and reasons put forward by others on past performance of the internal value stream and relating to metrics and other evidence
- prioritising improvement proposals and actions and justifying priorities to others
- negotiating with others using analysis of information, including past and proposed metrics and concepts to achieve a consensus position
- analysing restrictions and non-conformances to root cause
- standardising team-level processes

### Required knowledge

Required knowledge includes:

- competitive systems and practices principles, processes and techniques

- organisational goals, products and processes
- processes and procedures for continuous improvement in the workplace
- processes and procedures used in members of the internal value stream
- value stream mapping and analysis techniques
- approval processes within own organisation
- benefit/cost analysis methods
- methods of determining the impact of a change
- communication methods across a variety of media and formats, including preparation of formal proposals and negotiations
- customer perception of value

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• facilitate improvements in the value stream</li> <li>• identify value stream restrictions to further improvement</li> <li>• develop consensus solutions</li> <li>• jointly implement and monitor solutions with others, including team members and value stream members.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>

<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and</li> </ul>
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	<p>proprietary systems</p> <ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Opportunities for continuous improvement</b>	<p>Opportunities for continuous improvement may be:</p> <ul style="list-style-type: none"> <li>• beyond those arising just from within the team and will usually be within the site (gate-to-gate) or at least the organisation</li> </ul>
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used</p>
<b>HSE</b>	<p>All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE</p>
<b>Change</b>	<p>Changes may:</p> <ul style="list-style-type: none"> <li>• be to plant, procedures or practice</li> <li>• arise from continuous improvement (or an improvement event/project)</li> <li>• may have been intended to make an improvement or to implement new products, technology or systems</li> </ul>



	<ul style="list-style-type: none"> <li>include the implementation of a change</li> </ul> <p>Changes do not include an engineering review of a major capital expenditure or similar review</p>
<b>Presentation of information</b>	<p>Information may be presented:</p> <ul style="list-style-type: none"> <li>in terms of graphs or other appropriate visual forms</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>work team members</li> <li>value stream members</li> </ul>
<b>Results of change</b>	<p>The change may have results in:</p> <ul style="list-style-type: none"> <li>an initial improvement followed by a return to previous performance</li> <li>a change which has resulted in continued improvement</li> <li>continued detriment or other variations over time</li> </ul>
<b>Improvements</b>	<p>Improvements may:</p> <ul style="list-style-type: none"> <li>be to process, plant, procedures or practice</li> <li>include changes to ensure positive benefits are maintained</li> </ul>
<b>Changes which have not met target</b>	<p>Changes which have not met target may include:</p> <ul style="list-style-type: none"> <li>those that fall short and those that exceed expectations</li> </ul> <p>Appropriate action is to remove restrictions on those items which fell short, and make standard/further implement those which exceeded expectation</p>
<b>Sustaining improvement</b>	<p>Improvement may be sustained by including it in:</p> <ul style="list-style-type: none"> <li>standard procedures and work instructions</li> <li>standard practice</li> <li>other relevant documents and practices</li> </ul>
<ul style="list-style-type: none"> <li></li> </ul> <p><b>Team leader</b></p>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# MSS407005A Undertake a qualitative review of a process change

## Modification History

New unit, superseding MSACMG705A Undertake a qualitative review of a process change - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to review changes made in the operations systems, process or environment to ensure they result in improvement, that gains are maintained and that gains are used as a basis for further gains. The unit includes consensus decision-making and methods for capturing information on implemented changes, including quantitative and qualitative reports and informal talking to people to make sure gains are maintained and ways are found to build on them.

## Application of the Unit

This unit applies intended for team leaders and people with a similar sphere of influence and scope of authority and responsibility and who have knowledge of competitive systems and practices, continuous improvement and locking in improvements. Where this is not the case the following units can be completed to supply the necessary skills:

- *MSS403001A Implement competitive systems and practices*
- *MSS403002A Ensure process improvements are sustained*
- *MSS403041A Facilitate breakthrough improvements*
- *MSS403051A Mistake proof a production process.*

This unit covers the skills required for a qualitative approach to the review of a process change. This unit reviews both intended and unintended consequences of change and the effectiveness of the implementation of the change. For a more quantitative review of a process change refer to *MSS407003A Analyse process changes*.

This unit is not intended to be applied to a technical or engineering review of a major capital expenditure or similar review.

While this unit covers a qualitative review, some basic mathematics may be required although not sophisticated statistical or mathematical analysis.

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                |     |  |
|---|----------------|-----|--|
| 1 | Study a change | 1.1 | Identify changes which have occurred   |
|   |                | 1.2 | Select a change or group of related changes to analyse   |
|   |                | 1.3 | Determine the initiation of the selected change  |
|   |                | 1.4 | Gather information on the situation within the organisation and along the value stream prior to the change |
|   |                | 1.5 | Gather information on the implementation of the change   |
|   |                | 1.6 | Gather information on the intended benefits of the change  |
|   |                | 1.7 | Gather information on the situation within the organisation and along the value stream after the change    |
|   |                | 1.8 | Determine whether results of change have been constant or have changed over time                           |
|   |                | 1.9 | Collate and prepare gathered information for distribution  |

- |   |   |     |  |
|---|---|-----|--|
| 2 | Agree results of change with stakeholders | 2.1 | Present and discuss collected information with relevant stakeholders                                 |
|   |   | 2.2 | Modify collected information, as required, based on stakeholder input                                |
|   |   | 2.3 | Develop a consensus view of the result of the change which is supported by the information available |
|   |   | 2.4 | Validate the consensus view with stakeholders  |
|   |   |     |  |
| 3 | Identify future improvements              | 3.1 | Discuss lessons learned from the reviewed change with stakeholders                                   |
|   |   | 3.2 | Capture key knowledge from the review of the change in accordance with systems and procedures        |
|   |   | 3.3 | Identify future improvements in collaboration with team members                                      |
|   |   | 3.4 | Validate identified future improvements with stakeholders  |
|   |   | 3.5 | Obtain sign-off from process/system owner  |
|   |   | 3.6 | Start the process for implementing future improvements   |
|   |   | 3.7 | Check that planned improvements have occurred  |
|   |   | 3.8 | Take action to sustain improvement by standardising  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- determining and using qualitative research techniques appropriate for area of responsibility and relevant change process, including:
  - surveys
  - interviews
  - walking around (gemba walk)

- structured and unstructured interviews
- formal and informal interviews
- review of organisation records
- review of process 'history', such as might be obtained from a control panel or other process records
- undertaking qualitative research on past performance of plant, operations, products and procedures
- identifying trends and causal relationships and evidence offered by people consulted
- communicating and explaining results of quantitative research with others across a range of numeracy and literacy levels
- analysing views and reasons put forward by others on past performance and relating to evidence
- analysing views and reasons put forward by others for future changes and improvements and forming recommendations
- identifying key HSE strategies and risks for area of responsibility and identifying sources of expert assistance
- preparing recommendations, submissions and presenting a case for future changes

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles, processes and techniques
- organisational goals, products and processes
- qualitative research techniques, including:
  - surveys
  - interviews
  - walking around (gemba walk)
  - structured and unstructured interviews
  - formal and informal interviews
  - review of organisation records
  - review of process 'history' such as might be obtained from a control panel or other process records
- workplace continuous improvement processes and procedures
- variety of communication techniques, including:
  - face-to-face formal and informal interviews
  - surveys
  - telephone interviews
  - formal reports
  - presentations

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• determine and use appropriate qualitative research techniques</li> <li>• identify changes appropriate for qualitative research</li> <li>• undertake a qualitative review of a process change</li> <li>• gather information and undertake analyses over appropriate periods and ranges that will provide a valid basis for conclusions and recommendations</li> <li>• obtain a consensus view of the results of the change</li> <li>• determine the lessons to be learned and future improvements to be undertaken.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> </ul>

	<ul style="list-style-type: none"> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>lean operations</li> <li>agile operations</li> <li>preventative and predictive maintenance approaches</li> <li>monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>statistical process control systems, including six sigma and three sigma</li> <li>Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>supply, value, and demand chain monitoring and analysis</li> <li>5S</li> <li>continuous improvement (kaizen)</li> </ul>
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	<ul style="list-style-type: none"> <li>breakthrough improvement (kaizen blitz)</li> <li>cause/effect diagrams</li> <li>overall equipment effectiveness (OEE)</li> <li>takt time</li> <li>process mapping</li> <li>problem solving</li> <li>run charts</li> <li>standard procedures</li> <li>current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where changes include areas covered by industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Change</b>	<p>Changes may:</p> <ul style="list-style-type: none"> <li>be to equipment, operations, procedures or practice</li> <li>arise from continuous improvement (or an improvement event or project)</li> <li>may have been intended to make an improvement or to implement new products, technology or systems</li> <li>include the implementation of a change</li> </ul> <p>Changes do not include an engineering or technical review of a major capital expenditure or similar review</p>
<b>Initiation of change</b>	<p>A change may have been deliberately initiated to improve capability, deal with a problem, or a similar intended change. Where a change was not deliberately initiated then the causal factors for the change need to be identified and may include:</p> <ul style="list-style-type: none"> <li>a drift in efficiency or quality</li> <li>a change in materials, rate of supply, quality of supply, or, components which was being compensated for</li> <li>a change in personnel which brought different</li> </ul>

	practices
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• work team members</li> <li>• value stream members</li> </ul>
<b>Qualitative research</b>	<p>Qualitative research aims to gather information that may not be apparent from quantitative analysis techniques including the why and how of events relating to the change process. Examples of information gathered include:</p> <ul style="list-style-type: none"> <li>• employee support for a change before and after the change</li> <li>• other stakeholder support</li> <li>• understanding of employees of the intended benefits and the situation after the change</li> <li>• customer support for change</li> <li>• testing of possible contingencies and scenarios in the change process, including non-conformances (e.g. impact of breakdowns and absences)</li> </ul>
<b>Prior situation</b>	<p>The prior situation would include an analysis of culture and value alignment between:</p> <ul style="list-style-type: none"> <li>• downstream and upstream members of the value stream and the organisation</li> <li>• management and employees</li> <li>• skills required versus skills possessed</li> <li>• process capability</li> <li>• process and plant/equipment performance</li> </ul>
<b>Intended benefits</b>	<p>Intended benefits include impacts on:</p> <ul style="list-style-type: none"> <li>• customer perceived value</li> <li>• stakeholders upstream and downstream</li> <li>• organisation personnel</li> <li>• process capability</li> <li>• plant/equipment reliability/performance</li> </ul>
<b>Results of change</b>	<p>The change may have resulted in:</p> <ul style="list-style-type: none"> <li>• an initial improvement followed by a return to previous performance</li> <li>• a change which has resulted in continued improvement</li> <li>• continued detriment or other variations over time</li> </ul> <p>Results of change should include HSE changes</p>

<b>Improvements</b>	Improvements may: <ul style="list-style-type: none"><li>• be to process, plant, procedures or practice</li><li>• include changes to ensure positive benefits are maintained</li></ul>
<b>Sustaining improvement</b>	Improvement may be sustained by including it in: <ul style="list-style-type: none"><li>• standard procedures and work instructions</li><li>• standard practice</li><li>• other relevant documents and practices</li></ul>
<ul style="list-style-type: none"><li>•</li></ul> <b>Team leader</b>	Team leader may include: <ul style="list-style-type: none"><li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407006A Build relationships between teams in an operations environment**

### **Modification History**

New unit, superseding MSACMG706A Build relationships between teams in a manufacturing environment - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to develop an attitude of respect for individuals in teams and trust between individuals, teams, supervisors and management in order to develop a suitable culture for implementing and sustaining competitive systems and practices initiatives.

### **Application of the Unit**

This unit is intended for team leaders and people with a similar sphere of influence/scope of authority and responsibility. It builds on more general competitive systems and practices graduate units and specifically addresses inter-team issues. The unit also encompasses intra-team issues where these are a barrier. The unit envisages a specialist facilitation role in assisting with implementing an organisation competitive systems and practices culture.

It is also about developing a 'whole of value stream' view so that there is not competition between individuals or teams, but rather cooperation to achieve organisation and value stream goals with competition being directed towards other organisations competing in the marketplace.

This unit may also be applied to service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify organisational relationships	1.1	Map actual and intended process flows within and between teams
		1.2	Map actual and intended communication/information/data flows within and between teams
		1.3	Identify and map other interactions (actual and intended) within and between teams
		1.4	Determine the consequences in terms of customer benefit of intended flows/interactions
		1.5	Determine the consequences in terms of customer benefit of the actual flows/interactions
2	Foster cooperation within team	2.1	Present relationships information to team members
		2.2	Discuss areas where greater cooperation would yield benefits
		2.3	Agree on ways to achieve greater cooperation in these areas
		2.4	Facilitate team implementation of agreed changes
3	Foster cooperation between teams	3.1	Present relationships information to teams/team representatives

- |   |  |   |
|---|--|---|
|   | 3.2  | Discuss areas where greater cooperation would yield benefits  |
|   | 3.3  | Agree on ways to achieve greater cooperation in these areas   |
|   | 3.4  | Obtain any necessary approvals for proposed changes   |
|   | 3.5  | Facilitate implementation by teams of agreed changes  |
| 4 | Identify sources of tension, conflict or competition | <p>4.1 Examine team and individual key performance indicators (KPIs) for sources of conflict/competition</p> <p>4.2 Examine flows and interactions for possible sources of conflict and competition</p> <p>4.3 Observe interactions between team members and identify tensions, conflicts and competition</p> <p>4.4 Observe interactions between teams and identify tensions, conflicts and competition</p> <p>4.5 Observe response to change and resistance to change</p>   |
| 5 | Reduce causes of tension, conflict or competition    | <p>5.1 Draft modified KPIs to reduce causes of conflict and competition</p> <p>5.2 Draft modified systems causing conflicting flows and interactions</p> <p>5.3 Facilitate discussions within and between teams to identify causes of tensions, conflicts and competition</p> <p>5.4 Facilitate discussions to develop a consensus solution to identified causes of tensions, conflicts and competition</p> <p>5.5 Obtain any required approvals for suggested/drafted changes</p> <p>5.6 Facilitate the implementation of the agreed solutions</p> <p>5.7 Take actions to ensure agreed changes become standard practice</p> |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- identifying competitive systems and practices techniques and tools used by downstream, upstream and support teams, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - six sigma
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of KPIs/metrics
  - identification and elimination of waste (muda)
- determining value in terms of customer benefit for downstream, upstream and support teams
- determining impact on value of each team from operations of other teams
- communicating with other teams and team leaders, other employees and external representatives relevant to competitive systems and practices
- communicating using different media and format and to audiences and individuals from a variety of literacy and numeracy levels
- maximising cooperation between teams on:
  - setting of KPIs
  - solving problems to root cause
  - disruptions to flow
  - variations of flow level/volume
  - variations in quality/quantity/timeliness
  - implementing standardisation
- ensuring awareness of teams of performance requirements
- communicating sources of assistance to own and other team members

### Required knowledge

Required knowledge includes:

- competitive systems and practices principles, strategies and techniques, including:
  - value stream mapping
  - 5S

- JIT
- mistake proofing
- process mapping
- six sigma
- establishing customer pull
- kaizen and kaizen blitz
- setting of KPIs/metrics
- identification and elimination of waste (muda)
- organisational goals, products and processes
- types of KPIs, their applications and limits
- approval processes within organisation
- communication methods across a variety of media and formats, including preparation of formal proposals and negotiations
- continuous improvement
- process mapping, communication and people interaction mapping
- customer perception of value

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• critically examine relationships within and between downstream, upstream and support teams and to take action to improve them</li> <li>• identify relationships/relationship maps</li> <li>• identify sources of conflict/tension</li> <li>• consensus development of improvement plans, including setting of KPIs</li> <li>• implement improvement plans and rechecking subsequent relationships.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned,</li> </ul>



	<p>currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems,</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial in their impact on HSE
<b>Relationship between organisational teams</b>	<p>Organisational teams may include:</p> <ul style="list-style-type: none"> <li>• downstream customer teams</li> </ul>

	<ul style="list-style-type: none"> <li>upstream supplier teams</li> <li>support teams (e.g. maintenance and information technology (IT))</li> </ul> <p>Relationship between teams includes:</p> <ul style="list-style-type: none"> <li>the impact of teams on each others' work expressed in competitive systems and practices terms</li> </ul> <p>Impacts covered could include:</p> <ul style="list-style-type: none"> <li>supplier, customer and support team impacts on:             <ul style="list-style-type: none"> <li>flow</li> <li>pull</li> <li>takt time</li> <li>waste</li> </ul> </li> </ul>
<b>Cooperation within teams</b>	<p>Cooperation within team may include:</p> <ul style="list-style-type: none"> <li>assistance with problem solving</li> <li>dealing with disruptions to flow</li> <li>dealing with variations of flow level/volume</li> <li>dealing with variations in quality/quantity/timeliness</li> </ul>
<ul style="list-style-type: none"> <li><b>KPIs</b></li> </ul>	<p>KPIs may include:</p> <ul style="list-style-type: none"> <li>reward systems</li> <li>systems (formal and informal) which encourage some types of behaviour over others</li> </ul>
<ul style="list-style-type: none"> <li><b>Resistance to change</b></li> </ul>	<p>Resistance to change may be:</p> <ul style="list-style-type: none"> <li>overt or covert</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>work team members</li> <li>value stream members as well as other stakeholders</li> </ul>
<b>Team leader</b>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407007A Respond to a major non-conformance**

### **Modification History**

Release 2 - Missing text in PCs reinstated

Release 1 - New unit, superseding MSACMG707A Respond to a major non-conformance - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to lead a response at a team or area level to a major non-conformance which could have severe business impacts.

The unit can be applied to subsections of an organisation, such as a team, area or department, or in the case of a small or medium sized enterprise (SME), to the whole organisation.

### **Application of the Unit**

This unit applies to team leaders and people with a similar sphere of influence and scope of authority and responsibility and covers the skills required to respond to a situation where people, processes, equipment or systems fail to meet requirements (there is a major non-conformance) for whatever reason, and this will have significant business consequences. The non-conformance may be anywhere in the value stream, not necessarily in the team, department or area which needs to respond. Many teams, departments or areas may need to respond. However, this unit applies to the skills needed to lead a single team, department or area response.

This unit is not primarily about identification of the cause of the non-conformance but rather about skills for appropriate responses to contain the situation, including not allowing it to accelerate or cascade. It is also about skills to minimise the adverse consequences while doing what can be done at the team, department or area level to remedy the situation.

This unit does not cover the specialist skills required to contain/remediate an emergency non-conformance such as a fire or explosion. Relevant emergency management skills from other Training Packages should be accessed for these skills.

This unit may be also applied to service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Define extent and nature of non-conformance	1.1	Identify target performance prior to non-conformance
		1.2	Determine commencement and expected duration of non-conformance
		1.3	Determine impact of non-conformance on target performance
		1.4	Determine impact of non-conformance with health, safety and environment (HSE) performance
		1.5	Determine impact of non-conformance on maintenance performance
		1.6	Liaise with customers to determine minimum acceptable performance during period of non-conformance
		1.7	Define non-conformance in terms of customer requirements and target performance
2	Determine	2.1	Develop possible responses appropriate to the situation

- |  |     |   |
|--|-----|---|
| priorities and actions                           | 2.2 | Determine possible timing of possible responses   |
|  | 2.3 | Identify required resources for the responses developed   |
|  | 2.4 | Evaluate possible responses and select or shortlist responses                                       |
|  | 2.5 | Select responses and obtain necessary approvals   |
|  | 2.6 | Organise resources, as appropriate  |
|  |     |   |
| 3 Identify information needs                     | 3.1 | Determine the information needs of stakeholders   |
|  | 3.2 | Identify the sources of required information  |
|  | 3.3 | Arrange to collect required information   |
|  | 3.4 | Obtain authorisation to disseminate information   |
|  | 3.5 | Report information to stakeholders, as appropriate  |
| 4 Implement response                             | 4.1 | Initiate response and establish data and information collection procedures                          |
|  | 4.2 | Analyse data and other information as it comes to hand  |
|  | 4.3 | Determine progress of response to achieving required outcomes                                       |
|  | 4.4 | Modify response, including deployment of resources, as required, to better achieve desired outcomes |
| 5 Establish plan to return to normal conformance | 5.1 | Determine root cause of non-conformance and analyse to determine likely preventative measures       |
|  | 5.2 | Develop remedial plan to eliminate root cause   |
|  | 5.3 | Obtain sign-off from process/system owner for planned action  |
|  | 5.4 | Implement remedial plan and establish normal conformance  |

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|---|------------------------------|-----|--|
| 6 | Conclude and review response | 6.1 | Conduct a debrief and complete reports as required   |
|   |                              | 6.2 | Evaluate and review response and procedures  |
|   |                              | 6.3 | Evaluate and document effectiveness of the response function and its interaction/communication with stakeholders |
|   |                              | 6.4 | Recommend improvements to prevent a recurrence and improve response for other non-conformances                   |
|   |                              | 6.5 | Communicate reports in accordance with company procedures  |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation
- identifying obvious and not obvious non-conformances based on analyses of team or area key performance indicators (KPIs)
- determining and prioritising business impacts of non-conformance based on analysis of key indicators, such as:
  - effect on error rates and defects
  - loss of or delay in supply of materials or components
  - loss or severe restriction of process capability
  - loss of transport from or to operational centre or process facility
  - unplanned increases in costs of materials or services
  - increases in the cost of finance/capital
  - sudden change in regulatory requirements
- determining and prioritising responses based on:
  - customer requirements
  - the philosophies and strategies of the organisation
  - HSE requirements
  - delivery, statutory and contractual requirements
- negotiating formally and informally in highly varied and/or highly specialised contexts and while under time constraints and pressure from others



- solving problems to root cause, including analysis of implications of root cause
- establishing HSE environment of the team or area and determine HSE impact of a non-conformance

## Required knowledge

Required knowledge includes:

- the importance of standardisation in competitive systems and practices
- organisation processes and products
- customer needs as distinct from wants
- communication using a variety of media and formats methods
- sources of additional assistance and resources within the organisation
- approvals and delegations within the organisation

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• recognise extent and nature of a major non-conformance and deal effectively with a</li> <li>• define the impact of the non-conformance on operations and customers</li> <li>• develop and prioritise appropriate responses to contain the impacts of the non-conformance</li> <li>• implement, monitor and modify responses.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard</li> </ul>

	<p>control/management</p> <ul style="list-style-type: none"> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> </ul>
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	<ul style="list-style-type: none"> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>Major non-conformance</b>	<p>A major non-conformance may be:</p> <ul style="list-style-type: none"> <li>• a failure to receive a delivery</li> <li>• receiving a delivery which is out of specification</li> <li>• a failure of the transport system to make deliveries to customers or from suppliers</li> <li>• a problem in the process which fails to produce product or only produces non-conforming product</li> <li>• a major incident, such as a fire or loss of containment</li> <li>• a breakdown of critical plant/equipment</li> </ul>

	<ul style="list-style-type: none"> <li>• a commercial or legal problem which affects the ability to produce to requirements</li> <li>• excessive absences of key personnel due to illness or transport breakdown</li> <li>• a security situation preventing key personnel from performing their duties and/or deliveries being made</li> <li>• a major supply shortage or price increase</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Business impacts</b></li> </ul>	<p><b>Business impacts may include:</b></p> <ul style="list-style-type: none"> <li>• sudden increase in defect rates</li> <li>• loss of supply of materials or components</li> <li>• loss or severe restriction of operational capability</li> <li>• loss of transport from process</li> <li>• increases in fuel energy costs</li> <li>• increases in the cost of finance/capital</li> </ul>
<b>Performance</b>	<p>Performance includes:</p> <ul style="list-style-type: none"> <li>• the production volume, quality, cost, HSE and similar measures as appropriate at the team level</li> </ul>
<b>Response</b>	<p>Response includes all those strategies which will minimise the impact of the non-conformance on the customer and must be consistent with:</p> <ul style="list-style-type: none"> <li>• the philosophies and strategies of the organisation</li> <li>• HSE requirements</li> <li>• delivery, statutory and contractual requirements</li> </ul> <p>Response may include:</p> <ul style="list-style-type: none"> <li>• supply from another source</li> <li>• production from other areas</li> <li>• agreements for reduced supply</li> <li>• agreements to accept different quality</li> </ul> <p>Response duration may include:</p> <ul style="list-style-type: none"> <li>• short term response to cover immediate situation</li> <li>• different long and medium term response</li> <li>• transition strategies where there are different strategies at different phases of the response</li> </ul>
<ul style="list-style-type: none"> <li>• <b>Timing of responses</b></li> </ul>	<p>Timing of response may be controlled by the nature of the non-conformance and may include:</p> <ul style="list-style-type: none"> <li>• implementation following initial containment/stabilisation of situation (e.g. where the non-conformance is a major incident, such as a fire or loss of containment)</li> <li>• immediate initiation but delayed implementation (e.g.</li> </ul>

	<p>where the non-conformance is a breakdown of critical plant/equipment which will require repair/replacement before implementation)</p> <ul style="list-style-type: none"> <li>• immediate implementation (e.g. when the non-conformance does not prevent the response from starting or there is an alternative which bypasses the non-conformance)</li> </ul>
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• work team members, value stream members as well as other stakeholders and may be internal and external to the team and possibly the organisation</li> </ul>
<b>Team leader</b>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# MSS407008A Capture learning from daily activities in a organisation

## Modification History

New unit, superseding MSACMG708A Capture learning from daily activities in a manufacturing organisation - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to capture learning from the shop floor, suppliers and customers in order to contribute to a learning organisation.

## Application of the Unit

This unit is intended for team leaders and people with a similar sphere of influence/scope of authority and responsibility. It applies to individuals who already have knowledge of competitive systems and practices, leading teams, analysing root cause and locking in improvements. Where this is not the case the following units may be completed to supply the necessary skills:

- MSS402080A Undertake root cause analysis
- MSS403002A *Ensure process improvements are sustained*
- MSS403006A *Facilitate implementation of competitive systems and practices*
- MSS403013A *Lead team culture improvement.*

This unit takes a largely qualitative view of information and knowledge. For a more quantitative approach of capturing and analysing data and applying the knowledge deduced from that refer to *MSS408008A Analyse data for relevance to organisational learning.*

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify potential learning opportunities	1.1	Identify formal and informal opportunities for feedback from normal daily activities
		1.2	Assess feedback for potential to lead to organisational learning
		1.3	Identify opportunities for learning from abnormal events
		1.4	Review communications with value stream members for learning opportunities
2	Extract learning from opportunities	2.1	Review information gained from potential learning opportunities for relevance to performance improvement
		2.2	Discuss potential for learning with stakeholders
		2.3	Confirm additional knowledge/learning
		2.4	Confirm methods for institutionalising learning/standardising
3	Capture and disseminate learning	3.1	Identify methods of capturing and disseminating learning
		3.2	Obtain required authorisations from appropriate people

- |   |                        |   |
|---|------------------------|---|
|   | 3.3                    | Record learning according to organisation procedures                                      |
|   | 3.4                    | Communicate learning to relevant stakeholders   |
|   | 3.5                    | Ensure all relevant stakeholders are able to access and apply relevant knowledge/learning |
| 4 | Review use of learning |   |
|   | 4.1                    | Check learning is used in daily operations  |
|   | 4.2                    | Review use of learning and update in organisation knowledge system                        |
|   | 4.3                    | Identify implications for training and procedures   |
|   | 4.4                    | Recommend improvements to organisation knowledge system                                   |
|   | 4.5                    | Confirm methods for institutionalising learning/standardising                             |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation
- preparing reports and recommendations
- identifying and evaluating opportunities for feedback and learning, including:
  - tool box and other regular team, section and area meetings
  - ad hoc discussions/meetings with team members, sales and marketing employees, other employees, value stream members, regulators and visitors
  - interviews with employees and external organisation representatives
  - operations records which may include:
    - clip boards on the line
    - problem solving templates
    - procedures templates
    - whiteboards or other noticeboards



- computers or terminals that allow access to data bases and other electronic records
- maintenance records
- quality records
- suggestions from employees (e.g. suggestion schemes)
- warranty and other returns
- continuous improvement and breakthrough improvement activities (kaizen and kaizen blitz)
- complaints from customers, employees and members of the community
- equipment downtime/maintenance records
- selecting key information from feedback and learning opportunities and determining value for organisational learning
- analysing performance outside the normal range (good or bad) and assignable cause
- capturing learning through paper-based, electronic or other means (e.g. film and video)
- reviewing the use of learning, including analysing the cause and effect of integrating learning into current or future procedures

## Required knowledge

Required knowledge includes:

- competitive systems and practices tools, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators(KPIs)/metrics
  - identification and elimination of waste (muda)
- organisational goals, strategies, operations and processes
- continuous improvement strategies and processes
- communication methods and media for a range of audiences
- root cause analysis
- expected range of performance for operations and products
- types of knowledge capture and retrieval systems and their applicability

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• recognise, extract and record learning from daily activities</li> <li>• make and record ongoing additions to the organisation learning systems</li> <li>• determine best means of communicating learning to stakeholders</li> <li>• integrate learning with implementation of competitive systems and practices</li> <li>• establish continuous improvement for the learning system.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will</p>

	<p>be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> </ul>
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	<ul style="list-style-type: none"> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>Health, safety and environment (HSE)</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Opportunities for feedback</b>	<p>Opportunities for feedback include:</p> <ul style="list-style-type: none"> <li>• tool box meetings</li> <li>• ad hoc discussions/meetings with team members, sales and marketing employees, other employees, value stream members, regulators and visitors</li> <li>• interviews</li> <li>• process/production records</li> <li>• quality records</li> <li>• plant equipment downtime/maintenance records</li> </ul>
<b>Problem recognition and resolution</b>	<p>Problem recognition and resolution may be expected to include such approaches as:</p> <ul style="list-style-type: none"> <li>• stopping operations or part of an operation</li> <li>• go and see (gemba walk in lean operations)</li> <li>• team/consensus problem solving</li> <li>• root cause analysis (RCA)</li> </ul>
<b>Learning</b>	Learning is something which can be passed on and is a recordable event or method which leads to change in work practices and/or process or product performance that is able to be standardised/institutionalised
<b>Record</b>	<p>Appropriate records include systems which ensure knowledge:</p> <ul style="list-style-type: none"> <li>• is not just retained by an individual</li> <li>• is available to others</li> </ul>

	<ul style="list-style-type: none"><li>• survives beyond the departure of individual</li><li>• has an allocated level of importance</li></ul>
<b>Systems for the capture of knowledge</b>	<p>Systems for the capture of knowledge may be:</p> <ul style="list-style-type: none"><li>• paper-based, electronic or other</li></ul> <p>They may also require knowledge of method of knowledge entry and retrieval and possibly of searching/filing/cataloguing.</p>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"><li>• work team members</li><li>• value stream members</li><li>• supervisors</li></ul>
<b>Team leader</b>	<p>Team leader may include:</p> <ul style="list-style-type: none"><li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS407009A Facilitate improvements in the external value stream

### Modification History

New unit, superseding MSACMG709A Facilitate improvements in the external value chain - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to work with value stream members to improve the overall effectiveness of the value stream, so delivering greater value to the customer. It includes other organisations within the value stream/supply chain.

### Application of the Unit

This unit applies to managers and team leaders with appropriate authority and others with similar authority and responsibility for working with value stream members outside their own organisation. The value streams are referred to as 'source-to-destination' value streams. For skills associated with a 'gate-to-gate' (internal) value streams refer to *MSS407004A Facilitate improvements in the internal value stream*.

The unit includes the use of skills to resolve issues from one or more value stream members which impact on the overall ability of the value stream to continue to improve and offer better value to the customers. The improvement practices may (or may not) have used previously within their own organisation, other teams and organisations within the value stream. The unit does not cover mapping or managing value streams (refer to *MSS405002A Analyse and map a value stream* and *MSS405003A Manage a value stream*).

The unit applies to individuals who are familiar with competitive systems and practices, formal problem solving and root cause analysis (RCA), leading change and reducing costs. Where this is not the case the following units can be completed to supply the necessary skills:

- *MSS402080A Undertake root cause analysis*
- *MSS403001A Implement competitive systems and practices*
- *MSS403011A Facilitate implementation of competitive systems and practices*
- *MSS403030A Improve cost factors in work practices*.

Where previous improvements need to be evaluated refer to *MSS407005A Undertake a qualitative review of a process change* and *MSS407003A Analyse process changes*.

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Establish scope of value stream activity	1.1	Identify key individuals within value stream organisations
		1.2	Jointly identify possible areas of study
		1.3	Agree on a protocol for undertaking value stream improvement activities
		1.4	Confirm any special conditions of activity (e.g. confidentiality)
2	Study possible value stream improvements	2.1	Arrange meeting with suitable representatives of the value stream members
		2.2	Agree on extent of current implementation of competitive systems and practices in value stream
		2.3	Agree opportunities for improvement and any current or

- anticipated restrictions
- 2.4 Work with value stream representatives to determine root cause of restrictions
  - 2.5 Work with value stream member to identify possible solutions to problem
  - 2.6 Define outcomes from any proposed changes
- 3 Develop a consensus approach to implementing improvements
- 3.1 Determine benefits/costs to each value stream member from the proposed changes
  - 3.2 Decide whether the proposed improvements will result in a perceived improvement to the end customer
  - 3.3 Determine health, safety and environment (HSE) impacts as a result of the change
  - 3.4 Agree on proposed change/program of changes with all key stakeholders
- 4 Obtain required approvals
- 4.1 Draft a formal proposal for the proposed changes
  - 4.2 Submit proposal for all required approvals from stakeholders
  - 4.3 Modify proposal, as required, in liaison with all key stakeholders
  - 4.4 Obtain sign off from all process/system owners
- 5 Measure and communicate gains
- 5.1 Agree indicators/metrics of success of proposed changes
  - 5.2 Make arrangements to collect necessary data
  - 5.3 Make arrangements for the data to be analysed and presented in an agreed format to the agreed stakeholders
  - 5.4 Agree on the communication plan
  - 5.5 Liaise with stakeholders to implement changes as agreed and approved



- |   |               |     |  |
|---|---------------|-----|--|
| 6 | Review change | 6.1 | Analyse results of change  |
|   |               | 6.2 | Identify areas where planned improvements have occurred                    |
|   |               | 6.3 | Take action to sustain improvement by standardising                        |
|   |               | 6.4 | Identify areas which have not met predicted outcome (positive or negative) |
|   |               | 6.5 | Determine cause of target not being met                                    |
|   |               | 6.6 | Take appropriate action to improve the value stream                        |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- examining possible improvements and determine costs and benefits to customers, shareholders, employees and other stakeholders
- prioritising improvements in terms of benefits to ultimate customers
- communicating across all levels in organisations
- presenting to others the benefits of change in a manner that develops consensus (win/win)
- developing strategies and metrics to monitor the implementation of improvements
- initiating, planning and executing change across broad and specialised contexts
- adjusting improvement strategies on the basis of review findings and feedback
- analysing restrictions and non-conformances in value stream to root cause

### Required knowledge

Required knowledge includes:

- competitive systems and practices principles, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing

- process mapping
- establishing customer pull
- kaizen and kaizen blitz
- setting of key performance indicators (KPIs)/metrics
- identification and elimination of waste (muda)
- own organisation goals, operations and processes
- confidentiality and other sensitivities of value stream members
- any regulatory, issues which may be relevant to the value stream, including:
  - HSE
  - Trade Practices
  - contract and commercial Acts and regulations
- continuous improvement and the workplace improvement processes and procedures
- value stream members' processes
- value stream mapping and analysis
- approval processes within each organisation
- benefit/cost analysis methods
- methods of determining the impact of a change
- communication methods
- customer perception of benefits

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• identify competitive systems and practices techniques used by value stream members</li> <li>• create consensus on and facilitate improvements in the value stream.</li> <li>• identify value stream restrictions to further improvement and determining root cause</li> <li>• develop consensus solutions</li> <li>• jointly implement and monitor solutions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p>

	<p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the

performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Opportunities for continuous improvement</b>	Opportunities for continuous improvement may be beyond those arising just from within the organisation
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest

	version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Change</b>	<p>Changes may:</p> <ul style="list-style-type: none"> <li>• be to plant, procedures or practice</li> <li>• be to logistics, communication systems (e.g. ordering, supplying and quality certification)</li> <li>• include kanban/systems, SCAD) supply/resupply systems across the chain</li> <li>• arise from continuous improvement or an improvement event/project</li> <li>• have been intended to make an improvement or to implement new products, technology or systems</li> <li>• include the implementation of a change</li> </ul> <p>Changes do not include an engineering review of a major capital expenditure or similar review</p>
<b>Presentation of information</b>	<p>Information may be presented:</p> <ul style="list-style-type: none"> <li>• in terms of graphs or other appropriate visual forms</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• work team members</li> <li>• value stream members</li> </ul>
<b>Results of change</b>	<p>Results of change may include:</p> <ul style="list-style-type: none"> <li>• an initial improvement followed by a return to previous performance</li> <li>• a change which has resulted in continued improvement</li> <li>• continued detriment or other variations over time</li> </ul>
<b>Improvements</b>	<p>Improvements may:</p> <p>be to process, plant, procedures or practice</p> <ul style="list-style-type: none"> <li>• include changes to ensure positive benefits are maintained</li> </ul>
<b>Changes which have not met target</b>	<p>Changes which have not met target may include:</p> <ul style="list-style-type: none"> <li>• those that fall short and those that exceed expectations</li> </ul> <p>Appropriate action is to remove restrictions on those items which fell short, and make standard/further implement those which exceeded expectation</p>

<b>Sustaining improvement</b>	Improvement may be sustained by including it in: <ul style="list-style-type: none"><li>• standard procedures and work instructions</li><li>• standard practice</li><li>• other relevant documents and practices</li></ul>
<ul style="list-style-type: none"><li>• <b>Team leader</b></li></ul>	Team leader may include: <ul style="list-style-type: none"><li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407010A Improve visual management in the workplace**

### **Modification History**

New unit, superseding MSACMG710A Improve visual management in the workplace - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to assess current visual management strategies and techniques in the workplace and improve the application of visual management strategies and techniques and their integration into the overall competitive improvement approach of the organisation.

### **Application of the Unit**

This unit applies to improving an organisation's visual management in the workplace. The level of existing visual management is not required to be extensive for the unit to apply. This unit covers examining the workplace to determine the effectiveness of current visual management strategies and tools, the determination of additional/alternative visual management strategies and tools and their integration into overall improvement strategies within the organisation.

The visual management may be applied to the whole organisation or a production area or a support area and can either be active visual management strategies, such as operator controlled status indicators, or passive, such as information boards or information islands containing production and other data, to give employees access to production, occupational health and safety (OHS), equipment availability or other data.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |  |     |   |
|---|--|-----|---|
| 1 | Determine current visual management activities and information needs | 1.1 | Identify current visual management activities and provided information  |
|   |  | 1.2 | Establish extent of linkage of visual management activities and provided information to other competitive systems and practices strategies and techniques |
|   |  | 1.3 | Identify problems and improvements which could be made  |
|   |  | 1.4 | Determine root cause of problems  |
|   |  | 1.5 | Determine visual management techniques and information needs for improvement to occur   |
|   |  | 1.6 | Determine benefit which would accrue from improvement and cost of providing the information   |
| 2 | Choose which things to display visually                              | 2.1 | List all valuable information identified  |
|   |  | 2.2 | Rank possible information based on benefit/cost or other agreed basis   |
|   |  | 2.3 | Agree on the critical information and possible information sources which should be included in the visual management system                               |
|   |  | 2.4 | Negotiate the provision of this critical information to an adequate precision and in a timely manner  |
| 3 | Choose display   | 3.1 | Choose the most appropriate display method for each   |



method	item of critical information
	<p>3.2 Determine the most appropriate location for the visual display of each item of critical information</p> <p>3.3 Determine the appropriate source and approving authority for display information</p> <p>3.4 Review the chosen information, information source, display method and location to ensure the right display of the right information</p> <p>3.5 Validate data/information as required by methodology</p>
<p>4 Review the results of visual management</p>	<p>4.1 Review actual benefit gained and the actual cost of providing the information</p> <p>4.2 Validate the appropriateness of the information provided for delivering the intended outcome</p> <p>4.3 Initiate appropriate improvements to the visual management system</p> <p>4.4 Follow through on improvement actions to ensure they are fully implemented</p>

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- cooperating and working with others, both internally and externally to the work group
- determining the information to be displayed and location of displays through:
  - discussions with users
  - discussion with generators of information (e.g. sales, marketing, production planning or maintenance departments to determine available information)
  - comparing current state with future state
  - identifying information-related causes of current problems and non-conformances
- determining and communicating to others the purpose of visual management techniques and indicators in the operation, including:

- making the problems, abnormalities or deviations from standard visible to everyone and thus corrective action can be taken immediately
- displaying the operating or progress status in a easy to see format
- providing instruction
- conveying information
- providing immediate feedback to people
- support and create structure and links in process
- improving health, safety and environment (HSE) performance
- developing agreement on standards and indicators to be used
- analysing and planning
- communicating across all levels in an organisation using a variety of techniques and media
- solving problems to root cause
- prioritising improvements and problems according to impact on value creation

## Required knowledge

Required knowledge includes:

- concept of value and value add in terms of the customer
- understanding of the organisation's operations and processes subject to visual management
- visual management techniques, including:
  - comparators, status and indicators
  - colour standards and standard signalling tools
  - and-on lights (visual alarm of a problem – manual or automatic actuation, may also include audible alarm)
  - the use of tags, labels and similar
- visual management strategies to provide information to employees, including:
  - to provide status at a glance (normal versus abnormal conditions/quality)
  - to reinforce standard work
  - to predict quality/productivity problems
  - to provide instructions, directions and reminders
  - to inform, alert and motivate workers
  - as a safety and environmental tool
- the application of visual management as part of:
  - 5S and, 5S audits
  - quick changeover
  - proactive maintenance
  - kanban
  - flow
  - waste walks
  - kaizen and kaizen blitz events

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• assess current visual management displays, strategies and effectiveness</li> <li>• determine visual management improvement strategy</li> <li>• undertake visual management improvement</li> <li>• implement (or initiate and follow through on the implementation of) the actions which flow from the visual management project</li> <li>• examine the outcomes and identify improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> </ul>

	<ul style="list-style-type: none"> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>lean operations</li> <li>agile operations</li> <li>preventative and predictive maintenance approaches</li> <li>monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>statistical process control systems, including six sigma and three sigma</li> <li>Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>supply, value, and demand chain monitoring and analysis</li> <li>5S</li> <li>continuous improvement (kaizen)</li> </ul>
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	<ul style="list-style-type: none"> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Method for displaying information</b>	<p>Method for displaying information may include:</p> <ul style="list-style-type: none"> <li>• colour coding</li> <li>• pictures/graphics</li> <li>• kanban cards</li> <li>• coloured lines</li> <li>• signage</li> <li>• labelling</li> <li>• control boards</li> <li>• area information boards</li> <li>• gauges and dials</li> <li>• checklists</li> <li>• Gantt charts</li> </ul>
<ul style="list-style-type: none"> <li>•</li> </ul> <p><b>Where to display</b></p>	<p>Information may be displayed:</p> <ul style="list-style-type: none"> <li>• at the machine or cell/on the plant or equipment (e.g. performance feedback and process conditions)</li> <li>• at a workstation (e.g. work instructions)</li> <li>• on a control panel</li> <li>• centrally (e.g. general plant or team information)</li> <li>• visible to all (e.g. and-on lights and HSE alarms)</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS407011A Manage benchmarking studies

### Modification History

New unit, superseding MSACMG711A Manage benchmarking studies - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to undertake benchmarking studies, either directly or as a leader in a team undertaking benchmarking. It covers both performance and process benchmarking. It does not cover product or strategic benchmarking.

### Application of the Unit

This unit applies to individuals who undertake benchmarking as an input to an improvement process. The benchmarking may be used to find areas for improvement or to provide information as to how to make the improvements.

The benchmarking process would:

- decide the nature of the benchmarking to be undertaken
- collect the benchmarking data and information
- determine what actions to be taken based on the benchmarking
- take the required steps to have those actions implemented
- identify the ongoing nature of these benchmarking activities.

Benchmarking may be undertaken by a team or be largely the responsibility of an individual. This unit applies either to that individual or to a leader in the team. The benchmarking activity may use benchmarks which are derived either internally to the organisation or externally from the organisation although some degree of externality would be expected in most applications.

This unit does not require the statistical or financial analysis of data, but does require the interpretation and application of information derived from such analyses.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Identify nature of benchmarking activity	1.1	Identify operations or area to be benchmarked
		1.2	Determine the core set of benchmark measures required
2	Develop the benchmarking methodology	2.1	Determine baseline in area of study for core measures
		2.2	Confirm nature and source of data/information to be collected
		2.3	Agree on likely suitable sources of benchmarking data/information
		2.4	Confirm required survey methodology
3	Conduct benchmarking survey	3.1	Establish required communication channels for survey
		3.2	Obtain required data/information
		3.3	Validate data/information as required by methodology
4	Apply results of benchmarking	4.1	Interpret the analysed results of the survey
		4.2	Agree required improvement actions resulting from the



		survey
	4.3	Analyse health, safety and environment (HSE) implications from proposed actions
	4.4	Modify proposed actions as required to ensure they are at least HSE neutral
	4.5	Initiate the implementation of the improvement actions
	4.6	Follow through on improvement actions to ensure they are fully implemented
5	Improve the benchmarking process	5.1 Analyse the benchmarking process just undertaken 5.2 Analyse the changes which have resulted from the benchmarking 5.3 Identify areas for improvement 5.4 Agree ways of improving future benchmarking activities

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation
- determining operations or area to be benchmarked by:
  - previous benchmarking
  - identification by other studies or processes of area of need
  - informal conversations with customers, employees or suppliers
  - exploratory research techniques such as focus groups
  - in-depth marketing research, quantitative research, surveys, questionnaires, engineering analysis, process mapping, quality control variance reports, or financial ratio analysis
- interpreting data and qualitative information gained from benchmarking
- cooperating and working with others, both internally and externally to the work group
- analysing and planning

- communicating effectively (both receiving and sending communications)
- solving problems to root cause
- prioritising benchmarking needs and data in relation to organisation goals, objectives and strategies

## Required knowledge

Required knowledge includes:

- the organisation's performance data and/or processes subject to the benchmarking to a level needed to identify appropriate applications for benchmarking and apply the benchmarking results to it
- benchmarking protocols
- benchmarking code of practice
- legal and ethical issues involved in benchmarking
- different approaches to benchmarking and their applications
- performance versus process benchmarking
- criterion referenced versus qualitative versus quantitative benchmarking and the applications of each
- group processes
- own organisation's intellectual property and stance on confidentiality
- benchmarking partners' attitudes to confidentiality
- application of benchmarking to continuous improvement and the concept of continually improving best practice
- distinction between measurable data and useful information
- validity of benchmarking measures, data and information
- measures of data quality and methods of improving the quality of benchmarking information
- application of benchmarking data and information to Balanced Scorecard approaches

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• determine priority operations or areas for benchmarking</li><li>• undertake benchmarking</li><li>• implement (or initiate and follow through on the</li></ul>
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	<p>implementation of) the actions which flow from the benchmarking</p> <ul style="list-style-type: none"> <li>• examine the outcomes and identify improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads, and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
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<b>Sources of benchmarking data</b>	<p>Sources of benchmarking data may include:</p> <ul style="list-style-type: none"><li>• other relevant areas within the same organisation</li><li>• external organisations in a similar market/with similar processes</li><li>• external organisations recognised as a leader in the process/activity under study</li><li>• benchmarking consultancies offering access to relevant data/information/organisations</li></ul>
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407012A Lead a problem solving process to determine and solve root cause**

### **Modification History**

New unit, superseding MSACMG712A Lead a problem solving process to determine and solve root cause - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to guide or lead a problem solving process to solve complex and/or unusual problems. The problem solving process will usually involve the use of either real or nominal groups to determine the root cause and propose the solution.

### **Application of the Unit**

This unit will typically be undertaken by managers and/or technical experts who are confronted by a complex problem to which they need to develop a solution. The problem may be related to any area or process within the organisation or in the value stream and may have been formally presented to the individual for consideration or arise as part of other work.

The person may or may not have the required technical expertise for the particular problem, although the problem will require technical expertise to be solved. The problem may be capable of being adequately defined at the beginning of the problem solving activity, or may be progressively defined through continued iterations of the problem solving activity.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |                                     |   |
|---|-------------------------------------|---|
| 1 | Recognise complex problem           | 1.1 Identify a complex issue which needs to be addressed<br>1.2 Undertake an initial investigation of the issue<br>1.3 Determine initial areas of expertise and data which may be required to analyse the problem<br>1.4 Develop an initial definition of the problem   |
| 2 | Develop problem solving methodology | 2.1 Draft a problem solving methodology<br>2.2 Develop required approaches and protocols for obtaining required data and information<br>2.3 Establish group to assist with problem solving<br>2.4 Allocate tasks, responsibilities and reporting arrangements to group<br>2.5 Develop arrangements for consultation with required people outside of group |
| 3 | Analyse problem                     | 3.1 Apply methodology<br>3.2 Obtain data/information<br>3.3 Review problem definition<br>3.4 Review methodology<br>3.5 Obtain additional data/information as required   |

- |   |  |     |   |
|---|--|-----|---|
| 4 | Identify root cause                      | 4.1 | Map causal links for the problem                                  |
|   |  | 4.2 | Determine indicators of the problem or the problem precursors     |
|   |  | 4.3 | Identify causes which can be controlled/brought under control     |
|   |  |     |   |
| 5 | Develop a solution                       | 5.1 | Develop solutions for controllable causes                         |
|   |  | 5.2 | Determine benefit/cost for proposed solutions                     |
|   |  | 5.3 | Investigate proposed solutions for efficacy                       |
|   |  | 5.4 | Select the best available solution                                |
|   |  | 5.5 | Obtain necessary support and authorisations for proposed solution |
|   |  |     |   |
| 6 | Check problem is solved and standardised | 6.1 | Monitor indicators of problem/problem precursor                   |
|   |  | 6.2 | Review problem solution/implementation as required                |
|   |  | 6.3 | Ensure appropriate solution is standardised                       |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- cooperating and working with others, both internally and externally to the work group
- researching and collating information from a variety of sources, including non-obvious sources
- analysing and planning in highly varied and/or highly specialised contexts
- quantitative and qualitative data interpretation and application skills
- communicating effectively (both receiving and sending communications)
- applying problem solving methodology, including:



- cross-functional problem solving team
- cross-functional nominal group (virtual team)
- consulting and or brainstorming with members from outside the organisation on some basis
- input from other members of the value stream
- the use of known/proprietary problem solving approaches or some synthesis of methods
- own or commissioned research either in whole or in part
- prioritising possible solutions on benefit/cost basis and value to the customer
- selecting solution and checking efficacy, including checking:
  - the solution breaks the causal tree
  - other causes are not able to cause the problem
  - benefit/cost ratio is acceptable
  - solution can be implemented
  - permanence of solution
- standardising solutions by:
  - checking that implemented solution solves the problem
  - solution can be applied to all relevant standards within the organisation, including:
    - standard operating procedures/work instructions
    - actual work practice
    - maintenance manuals and similar
    - product and/or process specifications

## Required knowledge

Required knowledge includes:

- organisational goals, products and processes
- sources of data (actual and possible) within the organisation and the value stream
- understanding of the techniques and methodologies of formal problem solving
- data required for problem solving and alternative/proxy data sources
- benefit/cost analysis

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and</b>	A person who demonstrates competency in this unit must
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<b>evidence required to demonstrate competency in this unit</b>	<p>be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• undertake complex problem identification</li> <li>• establish appropriate methodologies, including establishing team responsibilities, to achieve root cause identification</li> <li>• prioritise solutions</li> <li>• recommend solutions and implementation procedures within the organisation and the value stream</li> <li>• evaluate implementation of solutions</li> <li>• standardise solutions.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to</p>

	accommodate ethnicity, age, gender, demographics and disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull- related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul>
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	<p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Complex problem</b>	<p>A complex problem may be described as one which has several of the following characteristics:</p> <ul style="list-style-type: none"> <li>requires going into the value stream for data/information</li> <li>is wider than just applying to a single job</li> <li>applies to less common solutions or problems</li> <li>requires a higher level of knowledge and skill (which may or may not be possessed directly by the person solving the problem), such as: <ul style="list-style-type: none"> <li>significant specialist knowledge</li> <li>significant specialist skill</li> <li>more theory/understanding of technology or process</li> </ul> </li> <li>data is not easily available and may need particular strategies to obtain, such as: <ul style="list-style-type: none"> <li>overcoming resistance from people including employees, customers or suppliers</li> <li>extracting data not regularly reported from SCADA or similar systems</li> <li>the problem and/or proposed solutions require reporting or authorisations from a Board or external authorities, such as licensing or regulatory bodies</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li><b>Problem recognition</b></li> </ul>	<p>The problem recognition may include:</p> <ul style="list-style-type: none"> <li>an obvious and current complex problem</li> <li>an intractable problem which has been known about and 'lived with' for some time</li> <li>a complex problem which has not been previously recognised</li> </ul> <p>The problem may, or may not be capable of complete definition at the start of the problem solving process (so requiring an iterative process)</p>
<b>Group</b>	<p>Problem will be such that it is beyond the scope of an individual to solve and so a group is required. The group</p>

	<p>may be:</p> <ul style="list-style-type: none"><li>• real (i.e. physical or face to face)</li><li>• nominal (i.e. never meets and may not know who each other is)</li><li>• or any combination in between</li></ul>
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## Unit Sector(s)

Unit sector                      Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS407013A Review continuous improvement processes**

### **Modification History**

New unit, superseding MSACMG700A Review continuous improvement processes - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills and knowledge required to undertake the local level review and further development of an existing continuous improvement process.

### **Application of the Unit**

This unit is intended for team leaders and people with a similar sphere of influence/scope of authority and responsibility. It applies to individuals who are already familiar with change leadership in a competitive systems and practices environment through either previous study or industry experience. Where this is not the case MSS403010A Facilitate change in an organisation implementing competitive systems and practices may be completed to supply the necessary skills.

Skills covered by this unit apply to the review of existing continuous improvement processes in a team, area or department environment, or a small or medium sized enterprise (SME). This unit may also be applied to service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

This unit contains employability skills.

### **Elements and Performance Criteria Pre-Content**

Elements describe the      Performance criteria describe the performance needed to

essential outcomes of a unit of competency.

demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Review continuous improvement practice	1.1	Review performance against current key performance indicators (KPIs)
		1.2	Review KPIs for ongoing relevance
		1.3	Review current state of continuous improvement processes
		1.4	Audit health, safety and environment (HSE) changes as a result of continuous improvement activity
		1.5	Analyse problems to determine root cause
		1.6	Identify areas for improvement to KPIs and continuous improvement processes
2	Develop plan for enhancing improvement processes	2.1	Prioritise areas requiring action
		2.2	Develop a range of possible solutions, including taking into account the impact of the solution on any codes of practice, standards, contracts, commercial or industrial agreements
		2.3	Discuss possible solutions and implications with stakeholders
		2.4	Compare outcomes from possible solutions to competitive systems and practices philosophy
		2.5	Choose actions which are most compatible with competitive philosophy
		2.6	Draft implementation plan for chosen action
		2.7	Obtain required approvals and modify plan, as required

- |   |  |     |  |
|---|--|-----|--|
| 3 | Implement enhanced improvement process | 3.1 | Communicate changes to improvement processes to team members             |
|   |  | 3.2 | Resolve issues and problems identified by team members                   |
|   |  | 3.3 | Obtain sign off from process/system owner                                |
|   |  | 3.4 | Arrange for skills development as necessary                              |
|   |  | 3.5 | Arrange for required resources to be available                           |
|   |  | 3.6 | Establish and implement KPIs for modified continuous improvement process |
|   |  | 3.7 | Implement planned changes  |
|   |  | 3.8 | Check the planned improvements have occurred                             |
|   |  | 3.9 | Take action to sustain improvement by standardising                      |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reviewing continuous improvement in a variety of contexts (e.g. supportive and non-supportive team environments)
- undertaking self-directed problem solving and decision-making
- communicating across all levels in the organisation
- analysing current state/situation
- analysing workplace strategy and vision statements and principles and linking these to current processes, performance and indicators

### Required knowledge

Required knowledge includes:

- competitive systems and practices tools, including:
  - value stream mapping



- 5S
- Just in Time (JIT)
- mistake proofing
- process mapping
- establishing customer pull
- kaizen and kaizen blitz
- setting of KPIs/metrics
- identification and elimination of waste (muda)
- methods of determining competency gaps in team members
- continuous improvement processes, including implementation, monitoring and evaluation strategies
- types of KPIs and their impacts on performance
- relationship between service departments (e.g. maintenance and continuous improvement in a production or operational environment)
- difference between breakthrough improvement and continuous improvement

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• critically review existing or proposed continuous improvement processes</li> <li>• establish ongoing review processes, including setting and monitoring of KPIs</li> <li>• develop consensus for implementation of improvement plans</li> <li>• implement improvement plans.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> </ul>

	<ul style="list-style-type: none"> <li>documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>reports from supervisors/managers</li> <li>case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>demonstration in the workplace</li> <li>workplace projects</li> <li>suitable simulation</li> <li>case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>lean operations</li> </ul>
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	<ul style="list-style-type: none"> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented should be at least neutral, or preferably beneficial, in their impact on HSE
<b>Relevance</b>	<p>Relevance of KPIs includes:</p> <ul style="list-style-type: none"> <li>• appropriateness (did they lead to/encourage desirable performance?)</li> <li>• currency (are they still encouraging desirable performance?)</li> </ul>

	<ul style="list-style-type: none"> <li>• unintended consequences (do they lead to outcomes which are not desirable, even if some performance is desirable?)</li> <li>• signal/noise (is the balance between desirable and undesirable outcomes strong and positive?)</li> </ul>
<b>Compare outcomes</b>	<p>Outcomes include comparing:</p> <ul style="list-style-type: none"> <li>• cost/benefit</li> <li>• timing</li> <li>• value stream implications</li> <li>• HSE issues</li> <li>• process reliability issues</li> <li>• benefit to customer/perceived customer benefit</li> </ul>
<b>Required resources</b>	<p>Required resources include:</p> <ul style="list-style-type: none"> <li>• plant</li> <li>• materials (e.g. raw materials, components, work in progress and other consumables)</li> <li>• energy (e.g. heating, cooling and fuel)</li> <li>• people</li> <li>• skills</li> <li>• finances</li> <li>• feedback/visual enterprise resources</li> <li>• measuring equipment</li> </ul>
<b>Sustaining improvement</b>	<p>Improvement may be sustained by including it in:</p> <ul style="list-style-type: none"> <li>• standard procedures and work instructions</li> <li>• standard practice</li> <li>• other relevant documents and practices</li> </ul>
<b>Team leader</b>	<p>Team leader may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of a team in a workplace</li> </ul>

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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# MSS408001A Develop the competitive systems and practices approach

## Modification History

New unit, superseding MSACMG801A Develop the competitive manufacturing approach - Equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to take a strategic view and further develop the organisation's competitive systems and practices philosophies and approaches.

## Application of the Unit

This unit applies to organisation leaders and is intended for managers and people with a similar sphere of influence and scope of authority and responsibility. It is a global unit covering the analysis and further development of the overall competitive systems and practices approach adopted by an organisation to ensure that the development fits with customer and other value stream member requirements. For a greater focus on reviewing and developing specific competitive systems and practices refer to *MSS408002A Audit the use of competitive tools*.

The unit applies to individuals who are familiar with competitive systems and practices as applied at an organisational level. Where this is not the case the following units can be completed to supply the necessary skills:

- *MSS405001A Develop competitive systems and practices for an organisation*
- *MSS405002A Analyse and map a value stream*
- *MSS405004A Develop business plans in an organisation implementing competitive systems and practices*
- *MSS405011A Manage people relationships.*

The following units may also be relevant in some circumstances:

- *MSS405005A Manage competitive systems and practices responding to individual and unique customer orders*
- *MSS405007A Introduce competitive systems and practices to a small or medium organisation.*

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Analyse organisation's current competitive systems and practices approach	1.1	Identify the organisation's competitive advantages and weaknesses
		1.2	Identify current health, safety and environment (HSE) profile
		1.3	Determine current competitive systems and practices/ proactive maintenance strategy and analyse for consistency of application across organisation
		1.4	Compare the strategy to current competitive needs
		1.5	Determine potential changes which might impact on competitive systems and practices strategy
		1.6	Identify areas where improvement is necessary
		1.7	Discuss potential improvement areas with relevant managers

- |   |  |     |  |
|---|--|-----|--|
| 2 | Analyse fit with value stream                                    | 2.1 | Review value stream map against current competitive and strategic position |
|   |  | 2.2 | Determine the impact of changes which have occurred                        |
|   |  | 2.3 | Identify areas where improvement is necessary                              |
|   |  |     |  |
| 3 | Review and modify the competitive systems and practices approach | 3.1 | Determine required strategy changes  |
|   |  | 3.2 | Negotiate changes with relevant stakeholders                               |
|   |  | 3.3 | Develop an agreed revised strategy   |
|   |  | 3.4 | Develop an agreed implementation plan                                      |
|   |  | 3.5 | Obtain support from process/system owners                                  |
|   |  | 3.6 | Manage the development of cascading tactical implementation plans          |
|   |  |     |  |
| 4 | Implement modified strategy                                      | 4.1 | Obtain necessary permissions and authorities                               |
|   |  | 4.2 | Monitor the implementation of the modified strategy and tactical plans     |
|   |  | 4.3 | Take required actions to achieve planned outcomes                          |
|   |  | 4.4 | Check that planned improvements have occurred                              |
|   |  | 4.5 | Take action to sustain improvement by standardising                        |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

#### Required skills include:

- **undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in highly varied and/or highly specialised contexts**



- analysing current state/situation of the organisation and value stream, including appropriateness of vision, strategy, operations and internal and external relationships especially with value stream members
- overseeing the setting of appropriate key performance indicators (KPIs)
- generating and evaluating complex proposals for improvement based on qualitative and quantitative data
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- prioritising situations and actions based on:
  - value for customers
  - cost/benefit analysis
  - readiness analysis
  - tactical survival response
- reviewing and modifying strategies and KPIs, as required

## Required knowledge

Required knowledge includes:

- competitive systems and practices at both a strategic and tools level, including advantages and limitations of:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - breakthrough improvement and continuous improvement (kaizen and kaizen blitz)
  - setting of KPIs/metrics
  - identification and elimination of waste (muda)
- six sigma and lean six sigma
- continuous improvement processes, including implementation, monitoring and evaluation strategies
- types of KPIs and their impacts on performance

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment

## Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>critically review current competitive systems and practices strategy and tactical implementation initiatives and plans in organisation and, where relevant, the value stream</li> <li>determine appropriateness of current KPIs</li> <li>establish process for ongoing review of strategies and tactical implementation initiatives</li> <li>implementation of improvement plans</li> <li>modify strategies, tactics and KPIs, as required.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>workplace procedures and plans relevant to work area</li> <li>specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>reports from supervisors/managers</li> <li>case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>demonstration in the workplace</li> <li>workplace projects</li> <li>suitable simulation</li> <li>case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess</p>

	<p>underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> </ul>
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	<ul style="list-style-type: none"> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Organisation</b>	<p>Organisation includes:</p> <ul style="list-style-type: none"> <li>• any part of a operations or service organisation</li> <li>• companies, government bodies or other body of people aiming to produce a product to service a customer</li> </ul>
<b>Sustaining improvement</b>	<p>Improvement may be sustained by including it in:</p> <ul style="list-style-type: none"> <li>• standard procedures and work instructions</li> <li>• standard practice</li> <li>• other relevant documents and practices</li> </ul>
<b>Manager</b>	<p>Manager may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS408002A Audit the use of competitive tools

### Modification History

New unit, superseding MSACMG802A Audit the use of competitive tools - Not equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to audit the use of competitive systems and practices tools, modify a tool or its application and change the mix of tools used as appropriate. It also covers changing the emphasis and culture away from the use of competitive systems and practices tools as the main focus to taking a whole of enterprise approach with the tools being seen as supporting measures to strategic goals. The unit has a more strategic focus than MSS407002A Review operations practice tools and techniques.

### Application of the Unit

This unit is intended for managers and people with a similar sphere of influence and scope of authority and responsibility. It is focused on auditing the practice of competitive systems and practices and implementing changes identified through the audit. For a more global unit covering developing the strategic approach adopted by the organisation refer to *MSS408001A Develop the competitive systems and practices approach*.

The unit includes monitoring workplace practice and the application of selected tools and taking action to ensure progress is continuing towards the desired future state.

The unit applies to individuals who are familiar with competitive systems and practices and with a broad range of competitive tools with depth in a moderate range of tools. Where this is not the case the following units which deal more with the selection and introduction of the correct tools for the organisation may be completed:

- *MSS405001A Develop competitive systems and practices for an organisation*
- *MSS405007A Introduce competitive systems and practices to a small or medium enterprise.*

This unit may also be applied to service organisations applying competitive systems and practices principles.

### Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Establish systems to monitor progress towards becoming competitive	1.1	Determine agreed indicators of progress towards desired future state
		1.2	Establish contribution to future state indicators by internal and external value stream contributors
		1.3	Capture information showing progress towards desired future state
		1.4	Analyse information to determine continued progress towards desired future state
		1.5	Ensure there are systems which allow monitoring to proceed routinely
2	Identify areas of operations practice to improve in consultation with work teams and other employees	2.1	Identify work teams, areas and value stream members which could be making better progress towards desired future state
		2.2	Examine competitive tools being used and their contribution towards progress
		2.3	Examine other work practices and their contribution

- towards progress
- 2.4 Manage required stakeholder consultations
  - 2.5 Agree on the cause or causes of progress which is not to plan
  - 2.6 Determine appropriate competitive tools use to improve progress
  - 2.7 Develop an implementation plan
- 3 Facilitate the improvement to operations practice across the organisation
- 3.1 Obtain support and necessary approvals from process/system owners
  - 3.2 Arrange for the introduction of new tools or modifications to existing tool practice as required
  - 3.3 Arrange for skills and other infrastructure development, as required
  - 3.4 Consult with stakeholders including value stream members about the impact of these changes
  - 3.5 Manage implementation of proposed changes to tools use

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision making on issues of a broad and/or highly specialised nature and in highly varied and/or highly specialised contexts
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- analysing current state/situation of the organisation and value stream
- overseeing the setting of key performance indicators (KPIs) for future state
- interpreting data and qualitative information gained from benchmarking
- analysing individually and collectively the implementation of competitive systems and practices tools in the organisation and determining strategies for improved implementation



- relating implementation and use of tools to customer benefit
- solving highly varied and highly specialised problems related to competitive systems and practices implementation to root cause
- negotiating with stakeholders, where required, to obtain information required for improvements, including management, unions, value stream members, employees and members of the community
- analysing operational processes in the organisation and value stream and relating to competitive systems and practices tools

## Required knowledge

Required knowledge includes:

- competitive systems and practices at both a strategic and tools level, including advantages and limitations of:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - breakthrough improvement and continuous improvement (kaizen and kaizen blitz)
  - setting of KPIs/metrics
  - identification and elimination of waste (muda)
- six sigma and lean six sigma
- best practice in implementation of competitive systems and practices tools
- customer benefit as used in competitive systems and practices
- ways of determining competency gaps that may act as restrictions in achieving best practice in operations
- define, measure, analyse, improve and control (DMAIC) process applied to competitive systems and practices tool use
- organisation desired future state in both quantitative and qualitative terms
- how to measure progress towards desired future state
- formal problem solving tools, including root cause analysis (RCA)

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>critically examine existing operations and determine correlations to implementation of competitive systems and practices tools</li> <li>supervise introduction of new tools or modification of the use of existing tools</li> <li>integrate tools with the overall operations strategy and future state.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>workplace procedures and plans relevant to work area</li> <li>specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>reports from supervisors/managers</li> <li>case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>demonstration in the workplace</li> <li>workplace projects</li> <li>suitable simulation</li> <li>case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>targeted questioning</li> <li>reports from supervisors, peers and colleagues (third-party reports)</li> <li>portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and</p>

	disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul>
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	<p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>the stage of implementation of competitive systems and practices</li> <li>the size of the enterprise</li> <li>the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Future state</b>	<p>Future state may include:</p> <ul style="list-style-type: none"> <li>process reliability</li> <li>waste</li> <li>health, safety and environment (HSE)</li> <li>maintenance</li> <li>systems</li> </ul>
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used</p>
<b>HSE</b>	<p>All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE</p>
<b>Organisation</b>	<p>Organisation includes:</p> <ul style="list-style-type: none"> <li>any part of a operations or service organisation</li> <li>companies, government bodies or other body of people aiming to produce a product to service a customer</li> </ul>
<b>Desired future state</b>	<p>Desired future state refers to:</p> <ul style="list-style-type: none"> <li>the agreed position of where the organisation wants to be as measured by performance indicators</li> </ul>
<b>Progress not to plan</b>	<p>Progress not to plan includes:</p> <ul style="list-style-type: none"> <li>both progress which falls short of plan and which exceeds plan</li> </ul>
<b>Improvements</b>	<p>Improvements include:</p> <ul style="list-style-type: none"> <li>the use of different or additional tools</li> <li>the application of the current tools in use in a different way</li> <li>a change of emphasis from 'tools' to an accepted part of the organisation's culture</li> </ul>
<b>Manager</b>	<p>Manager may include:</p> <ul style="list-style-type: none"> <li>any person who may have either a permanent or an ad hoc role in facilitating the function of multiple</li> </ul>

	teams in a workplace, departments or entire organisations
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## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS408003A Develop models of future state operations practice

### Modification History

New unit, superseding MSACMG803A Develop models of future state manufacturing practice - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to establish processes for identifying future state models of best practice for operations that are then used as the template for both strategic decision-making and goal setting. It may be applied to whole organisations or significant sections of the value stream.

### Application of the Unit

This unit applies in an environment where operations practices are standardised and there is a culture that accepts sustaining improvements and building on them. It is intended for managers and people with a similar sphere of influence.

This unit applies to individuals who are familiar with competitive systems and practices, value stream mapping, and culture improvement. Where this is not the case the following units can be completed to supply the necessary skills:

- *MSS405001A Develop competitive systems and practices for an organisation*
- *MSS405002A Analyse and map a value stream*
- *MSS405013A Facilitate holistic culture improvement in an organisation.*

This unit may also be applied to non-production areas and service organisations applying competitive systems and practices principles.

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

### Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

- |   |   |  |
|---|---|--|
| 1 | Develop a shared future state model                         | 1.1 Establish an appropriate representative team<br>1.2 Analyse a value stream map of an appropriate section of the value stream<br>1.3 Determine the current state of practice across the value stream<br>1.4 Identify overall organisation strategy, direction and competitive systems and practices philosophy<br>1.5 Validate view with process/system owner |
| 2 | Develop and review a collaborative best practice model      | 2.1 Develop a future state model of practice<br>2.2 Review model with process/system owners and other stakeholders across the value stream as appropriate<br>2.3 Modify model to deliver better results for the customer and reduce wastes<br>2.4 Develop implementation plan in consultation with stakeholders  |
| 3 | Provide the resources necessary to move to the future state | 3.1 Identify changes required to infrastructure<br>3.2 Determine benefit/cost for required changes<br>3.3 Prioritise required changes<br>3.4 Obtain required authorisations  |

- |   |                           |     |  |
|---|---------------------------|-----|--|
|   |                           | 3.5 | Facilitate the provision of resources needed to implement plan |
| 4 | Review future state model | 4.1 | Manage the implementation of improvements                      |
|   |                           | 4.2 | Identify measures of progress towards agreed future state      |
|   |                           | 4.3 | Review progress towards future state                           |
|   |                           | 4.4 | Agree methods of improving areas which could progress better   |
|   |                           | 4.5 | Agree on methods for evaluating future state                   |
|   |                           | 4.6 | Validate measures and methods with relevant managers           |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in highly varied and/or highly specialised contexts
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- determining current state of operations in the organisation or selected portion of the value stream across a range of key indicators, including:
  - output quantities and qualities
  - variability in quality and quantity
  - uptime
  - causes and times for the different wastes (muda)
  - investment hurdle rates and actual rates of return
  - health, safety and environment (HSE) indicators
  - reliability indicators
  - other key performance indicators (KPIs) indicators appropriate to the organisation and its technology and processes
- identifying desirable future state across a range of indicators of operations in the organisation



or selected portion of the value stream, including forecasts of:

- output quantities and qualities
- variability in quality and quantity
- HSE indicators
- reliability/uptime
- rates of return
- other indicators appropriate to the organisation and its technology and processes
- analysing data, including indicators of progress to future state
- prioritising actions according to:
  - benefit/cost analysis
  - readiness analysis
  - tactical survival response

## Required knowledge

Required knowledge includes:

- competitive systems and practices at both a strategic and tools level, including advantages and limitations of:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - breakthrough improvement and continuous improvement (kaizen and kaizen blitz)
  - setting of KPIs/metrics
  - identification and elimination of waste (muda)
  - six sigma and lean six sigma
- best practice in implementation of competitive systems and practices tools
- customer benefit as used in competitive systems and practices
- formal problem solving tools, including root cause analysis (RCA)
- workplace strategy and vision
- ways of determining competency gaps that may act as restrictions in achieving best practice in operations

## Evidence Guide

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The evidence guide provides advice on assessment and must be read in conjunction with the

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performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• review current and future state maps with stakeholders</li> <li>• analyse value stream maps</li> <li>• review progress towards future state and take corrective action</li> <li>• align the future state with organisation strategy.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made</p>

	to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> </ul>
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	<ul style="list-style-type: none"> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Organisation</b>	<p>Organisation includes:</p> <ul style="list-style-type: none"> <li>• any part of a manufacturing or service organisation</li> <li>• companies, government bodies or other body of people aiming to produce a product to service a customer</li> </ul>
<b>Representative team</b>	<p>Representative team includes:</p> <ul style="list-style-type: none"> <li>• members from the value stream representing key parts of that chain and may, or may not, include members from outside the organisation</li> </ul>
<b>Infrastructure</b>	<p>Infrastructure includes:</p> <ul style="list-style-type: none"> <li>• policies and procedures</li> <li>• plant and equipment</li> <li>• materials, energy, utilities and other consumables</li> <li>• workforce arrangements, including employee numbers, organisation structure, competencies and competency mix</li> </ul>
<b>Future state model of practice</b>	<p>The model of practice will be an improved future state model which will:</p> <ul style="list-style-type: none"> <li>• help achieve the required organisation strategy and philosophy</li> <li>• give direction to improvements and actions</li> <li>• include forecasts of key indicators</li> </ul>
<b>Measures of progress</b>	<p>Measures of progress include:</p> <ul style="list-style-type: none"> <li>• those metrics and other indicators defined and agreed before the commencement of implementation which provide feedback on the progress towards the future</li> </ul>

	state
<b>Manager</b>	<p>Manager may include:</p> <ul style="list-style-type: none"><li>• any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## MSS408004A Develop the value stream

### Modification History

New unit, superseding MSACMG804A Develop the value chain - Equivalent

### Unit Descriptor

This unit of competency covers the skills and knowledge required to develop or further develop a positive relationship with all value stream members so that they can work cooperatively to their mutual benefit and so deliver better value for the customer.

### Application of the Unit

The unit applies to managers and people with a similar sphere of influence and scope of authority and responsibility who are responsible for the further development of the value stream. Individuals completing this unit should be familiar with competitive systems and practices, value stream mapping and have an ability to relate to personnel in external organisations. Where this is not the case the following units may be completed to supply the necessary skills:

- *MSS405002A Analyse and map a value stream*
- *MSS405010A Manage relationships with non-customer external organisations.*

This unit applies where the value stream has been analysed and mapped and is already being managed. This unit is more about the relationships along the value stream than the direct flow of value, materials or goods. All value stream members are potentially covered.

This unit may also be applied to service organisations applying competitive systems and practices principles.

The equivalent team leader level unit to this unit is *MSS407004A Facilitate improvements in the internal value stream.*

### Licensing/Regulatory Information

Not applicable.

### Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

- |   |   |   |
|---|---|---|
| 1 | Review relationship with value stream members | 1.1 Identify areas which could be improved  |
|   |   | 1.2 Develop position of own organisation with regard to these areas   |
|   |   | 1.3 Discuss areas of interest (within relevant regulatory framework) with relevant value stream personnel and develop position of own organisation with regard to any issues raised |
|   |   | 1.4 Develop an agreed list of areas for action  |
|   |   | 1.5 Validate list with own management   |
|   |   | 1.6 Agree on a framework for progressing agreed list  |
| 2 | Manage changes                                | 2.1 Take required actions within own organisation to implement changes  |
|   |   | 2.2 Monitor progress of changes within own organisation   |
|   |   | 2.3 Take required actions to ensure changes achieve their objective   |
|   |   | 2.4 Monitor changes across value stream and their impacts   |
|   |   | 2.5 Provide appropriate assistance to value stream members  |

implementing agreed changes

- |   |   |     |   |
|---|---|-----|---|
| 3 | Manage ongoing relationship with value stream members | 3.1 | Undertake regular review of value stream relationships                        |
|   |   | 3.2 | Review benefits obtained and costs incurred by value stream members           |
|   |   | 3.3 | Review benefits obtained by customer/value stream as a whole                  |
|   |   | 3.4 | Optimise benefit/cost distributions and ratios across the value stream        |
|   |   | 3.5 | Explore areas of mutual benefit   |
|   |   | 3.6 | Analyse value stream synergies and conflicts                                  |
|   |   | 3.7 | Develop approaches to maximise customer benefit flowing from the value stream |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- analysing proposed and past changes to operations, products and processes within the value stream to determine if change adds or has added value to the customer
- making significant, high level, independent judgements on required improvements in the value stream
- demonstrating responsibility and broad-ranging accountability for decisions
- communicating and explaining quantitative and qualitative concepts and data with representatives of the value stream across a range of numeracy and literacy levels
- analysing views and reasons put forward by others on past performance of the value stream and relating to metrics and other evidence
- prioritising value stream improvement proposals and related actions and justifying priorities to others
- negotiating with others using analysis of information, including past and proposed metrics and concepts, to achieve a consensus position
- analysing restrictions and non-conformances to root cause
- standardising processes along the value stream



## Required knowledge

Required knowledge includes:

- competitive systems and practices principles, processes and techniques
- organisational goals, operations, products and processes
- operations, products and processes of value stream members
- continuous improvement and workplace improvement processes and procedures
- approval processes within own organisation and value stream members
- cost/benefit analysis methods
- methods of determining the impact of a change
- communication methods across a variety of media and formats, including preparation of formal proposals and negotiations
- customer perception of value

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• critically review value stream relationships and maximise the benefit flowing from them</li><li>• present and facilitate consensual improvements across the value stream</li><li>• critically evaluate the strengths and weaknesses of the value stream and its members</li><li>• facilitate and monitor changes along the value stream</li><li>• monitor changes and improvements against qualitative and quantitative indicators.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented</li></ul>

	<p>changes to work processes and procedures relevant to the assessee</p> <ul style="list-style-type: none"> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	Competitive systems and practices may include, but are
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	<p>not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• Just in Time (JIT), kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Value stream</b>	<p>The value stream begins with the customer and includes all actions (both value-adding and non-value added) by both internal sections/departments and external organisations to meet a customer requirement.</p> <p>Depending on the operations and the customer requirement stages where value stream actions may occur include:</p> <ul style="list-style-type: none"> <li>• sales outlet/representative</li> <li>• information gathering, data analysis and research</li> </ul>

	<ul style="list-style-type: none"> <li>• product design</li> <li>• raw material sourcing</li> <li>• intermediate processing</li> <li>• final assembler/collation/preparation</li> <li>• support services (e.g. accounting, finance and legal)</li> <li>• storage and delivery to customer</li> <li>• after market support</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>Health, safety and environment (HSE)</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Areas of interest</b>	<p>Areas of interest include:</p> <ul style="list-style-type: none"> <li>• commercial and contractual relationships with value stream members and include common regulatory and commercial frameworks</li> </ul>
<b>Change</b>	<p>Changes may:</p> <ul style="list-style-type: none"> <li>• be to plant, procedures or practice</li> <li>• arise from continuous improvement (or an improvement event/project)</li> <li>• have been intended to make an improvement or to implement new products, technology or systems</li> <li>• include the implementation of a change</li> </ul> <p>Changes do not include an engineering review of a major capital expenditure or similar review</p>
<b>Presentation of information</b>	<p>Information may be presented:</p> <ul style="list-style-type: none"> <li>• in terms of graphs or other appropriate visual forms</li> </ul>
<b>Stakeholders</b>	<p>Stakeholders may include:</p> <ul style="list-style-type: none"> <li>• work team members, value stream members as well as other stakeholders</li> </ul>
<b>Results of change</b>	<p>Results of change may include:</p> <ul style="list-style-type: none"> <li>• an initial improvement followed by a return to previous performance</li> <li>• a change which has resulted in continued improvement</li> <li>• continued detriment or other variations over time</li> </ul>
<b>Improvements</b>	<p>Improvements may:</p> <ul style="list-style-type: none"> <li>• be to process, plant, products, procedures or practice</li> </ul>

	<ul style="list-style-type: none"><li>include changes to ensure positive benefits are maintained</li></ul>
<b>Manager</b>	Manager may include: <ul style="list-style-type: none"><li>any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# **MSS408005A Develop the learning processes of the operations organisation**

## **Modification History**

New unit, superseding MSACMG805A Develop the learning processes of the manufacturing organisation - Equivalent

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to ensure that knowledge relevant to performance improvement and the meeting of customer requirements is gathered, applied and retained by the organisation and individuals. This unit focuses on the processes in an organisation for extracting learning as it appears, capturing it in a manner which makes it available for future use and applying it to work.

## **Application of the Unit**

The unit is intended for managers and people with a similar sphere of influence and scope of authority and responsibility who are familiar with competitive systems and practices and workplace learning. Where this is not the case *MSS405012A Manage workplace learning* may be completed to supply the necessary skills.

The equivalent team leader unit is *MSS407008A Capture learning from daily activities in a organisation*.

This unit may also be applied to service organisations applying competitive systems and practices principles.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify processes generating new knowledge	1.1	Identify any existing systems for organisational learning
		1.2	Encourage the open discussion of current performance and problems
		1.3	Facilitate consensus problem solving
		1.4	Ensure both qualitative and quantitative knowledge are captured
		1.5	Validate findings with relevant managers
2	Develop knowledge capture and retrieval systems	2.1	Obtain required approvals
		2.2	Provide useable systems for recording of problems, causes and solutions
		2.3	Facilitate the extraction of knowledge from records
		2.4	Ensure all project work captures generated knowledge
		2.5	Ensure knowledge is in a form able to be applied by the organisation and its personnel
		2.6	Develop knowledge storage and retrieval systems
		2.7	Monitor knowledge capture system use and suitability
3	Improve the application of	3.1	Ensure knowledge is distributed to and available where needed

organisational knowledge	3.2	Ensure knowledge system is part of standard procedures and practices
	3.3	Encourage the routine use of the knowledge system
	3.4	Facilitate open discussion of knowledge and knowledge system
	3.5	Identify inhibitors to greater use of knowledge
	3.6	Take actions to improve application of organisational knowledge
4 Evaluate and improve learning processes	4.1	Review use of knowledge system
	4.2	Evaluate benefits obtained from knowledge system
	4.3	Identify areas where the knowledge system is not being fully utilised
	4.4	Identify areas where greater benefits could be obtained from the knowledge system
	4.5	Discuss areas of possible improvements with relevant managers and other stakeholders
	4.6	Develop consensus improvement plans for the knowledge system
	4.7	Obtain required approvals
	4.8	Train personnel, as required, to improve use
	4.9	Implement improvement plans

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation



- preparing reports and recommendations
- implementing knowledge capture systems that cover:
  - existing plant and equipment modifications
  - changes to procedures and operations for information technology (IT) related systems and equipment
  - operations procedure and practice changes
  - new plant, equipment and processes
  - daily problem solving and continuous improvement activities
  - specific improvement events (e.g. kaizen blitz)
  - incident reports
  - reliability/maintenance reports
  - customer feedback
  - feedback from value stream members
- accessing and analysing current performance, including:
  - output indicators
  - input indicators
  - health, safety and environment (HSE) indicators
  - reliability/maintenance indicators
  - continuous improvement indicators
- implementing, monitoring and adjusting improvements to the knowledge system, including:
  - improving integration of knowledge system with other organisation and value stream development processes
  - improving identification of new knowledge
  - improving capture ease and efficiency
  - improving search and application functionality
- analysing performance outside the normal range (good or bad) and assignable cause

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles and tools, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - incremental and breakthrough improvement
  - setting of key performance indicators (KPIs)/metrics

- identification and elimination of waste (muda)
- organisational goals strategies, operations and processes
- approval processes within organisation
- cost/benefit analysis methods
- methods of determining the impact of a change
- communication methods and media for a range of audiences
- customer perception of value
- reward systems
- learning and knowledge management systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• review learning process across the organisation</li> <li>• relate learning processes to implementation of competitive systems and practices</li> <li>• identify components of current system that require improvement</li> <li>• develop improvements to current learning system, including setting of system metrics</li> <li>• manage implementation of improvements.</li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to</li> </ul>

	contingencies.
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP)</li> </ul>
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	<p>systems, Materials Resource Planning (MRP) and proprietary systems</p> <ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>HSE</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Problems</b>	<p>Problems may include:</p> <ul style="list-style-type: none"> <li>• non-conformances and other opportunities for improvement</li> </ul>
<b>Develop</b>	<p>Develop includes:</p> <ul style="list-style-type: none"> <li>• establishing and improving</li> </ul>
<b>Organisational learning</b>	Organisational learning refers to learning intended to be applied across the whole organisation or by specific teams, work areas or individuals

<b>Knowledge forms</b>	Knowledge may be: <ul style="list-style-type: none"><li>quantified or otherwise modified to make its outcomes measurable or observable as appropriate to the knowledge and its application</li></ul>
<b>Improvements</b>	Improvements may: <ul style="list-style-type: none"><li>be to process, plant, service, procedures or practice</li><li>include changes to ensure positive benefits are maintained</li></ul>
<b>Manager</b>	Manager may include: <ul style="list-style-type: none"><li>any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

## **MSS408006A Develop and refine systems for continuous improvement in operations**

### **Modification History**

New unit, superseding MSACMG806A Develop and refine systems for continuous improvement in manufacturing organisations - Equivalent

### **Unit Descriptor**

This unit of competency covers the skills, knowledge and processes required to ensure that continuous improvement systems do not stultify and continue to improve along with other operational systems in an organisation.

This unit is about improving the process yield/unit of effort or cost, reducing process variation and increasing process reliability, upgrading, enhancing or refining process outputs, and includes developing a culture of reviewing and sustaining change ensuring improvements are maintained and built on.

### **Application of the Unit**

This unit applies to managers and people with a similar sphere of influence and scope of authority and responsibility and who are familiar with competitive systems and practices, continuous improvement and locking in improvements. Where this is not the case the following units may be completed to supply the necessary skills:

MSS405001A Develop competitive systems and practices for an organisation

MSS405013A Facilitate holistic culture improvement in a operations organisation.

The equivalent team leader level unit is MSS407013A Review continuous improvement processes.

This unit may also be applied to service organisations applying competitive systems and practices principles.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Establish parameters of current internal improvement systems	1.1	Describe organisation systems that impact on continuous improvement
		1.2	Identify current relevant metrics and their values
		1.3	Check that metrics are collected for all improvements
		1.4	Determine yield of current improvement processes
		1.5	Review results of improvements
2	Distinguish breakthrough improvement processes	2.1	Identify all improvements which have occurred over an agreed period of time
		2.2	Distinguish between breakthrough improvements and continuous improvements
		2.3	Determine the timing of breakthrough improvement processes
		2.4	Analyse factors controlling the timing and selection of breakthrough improvements
		2.5	Analyse continuous improvements to identify cases where breakthrough improvements were required
		2.6	Validate findings with process/system owners and obtain

- required approvals
  - 2.7 Improve timing/selection of breakthrough improvements
  - 2.8 Improve other factors limiting the gains from breakthrough improvements
- 3 Develop continuous improvement practice
  - 3.1 Check that levels of delegated authority and responsibility are appropriate for continuous improvement from the shop floor
  - 3.2 Ensure all personnel have appropriate capabilities for continuous improvement processes
  - 3.3 Ensure personnel and systems recognise potential breakthrough improvement projects
  - 3.4 Ensure sufficient resources are available for the operation of continuous and breakthrough improvement processes
  - 3.5 Check that relevant information flows from improvement changes to all required areas and stakeholders
  - 3.6 Check data collection and metrics analysis capture changes which result from improvement actions
  - 3.7 Check that improvement changes are standardised and sustained
  - 3.8 Check review processes for routine continuous improvements
  - 3.9 Remove or change factors limiting gains from improvements
  - 3.10 Modify systems to ensure appropriate possible changes are referred to other improvement processes
  - 3.11 Institutionalise breakthrough
- 4 Establish parameters of current external improvement
  - 4.1 Review value stream systems that impact on improvement
  - 4.2 Review procedures for deciding improvement



systems		methodologies	
		4.3	Identify current relevant metrics and their values, as appropriate
		4.4	Determine yield of current improvement processes
		4.5	Review results of improvements
5	Explore opportunities for further development of value stream improvement processes	5.1	Review mechanisms for consultation with value stream members
		5.2	Develop mechanisms for further improving joint problem solving
		5.3	Develop mechanisms for increased sharing of organisational knowledge
		5.4	Obtain support and necessary authorisations from process/system owners
		5.5	Capture and standardise improvements
		5.6	Improve factors limiting gains from continuous improvements
6	Review systems for compatibility with improvement strategy	6.1	Review all systems which impact or are impacted on improvements and the improvement system
		6.2	Analyse relationships between improvement systems and other relevant systems
		6.3	Analyse practices caused by and results from the systems
		6.4	Negotiate changes to the systems to improve the outcomes from improvement systems
		6.5	Obtain necessary approvals to implement changes
		6.6	Monitor the implementation of the changes

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making on issues of a broad and/or highly specialised nature and in highly varied and/or highly specialised contexts
- communicating at all levels in the organisation and value stream and to audiences of different levels of literacy and numeracy
- analysing current state/situation of the organisation and value stream
- determining and implementing the most appropriate method for capturing value stream improvements
- collecting and interpreting data and qualitative information from a variety of sources
- analysing individually and collectively the implementation of competitive systems and practices tools in the organisation and determining strategies for improved implementation
- relating implementation and use of competitive systems and practices and continuous improvement to customer benefit
- solving highly varied and highly specialised problems related to competitive systems and practices implementation and continuous improvement to root cause
- negotiating with stakeholders, where required, to obtain information required for implementation and refinement of continuous improvements, including management, unions, value stream members, employees and members of the community
- reviewing relevant metrics, including all those measures which might be used to determine the performance of the improvement system, including:
  - key performance indicators (KPIs) for existing processes
  - quality statistics
  - delivery timing and quantity statistics
  - process/equipment reliability ('uptime')
  - incident and non-conformance reports
- implementing continuous improvement to support systems and areas, including maintenance, office, training and human resources

### Required knowledge

Required knowledge includes:

- competitive systems and practices tools, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing

- process mapping
- establishing customer pull
- kaizen and kaizen blitz
- setting of KPIs/metrics
- identification and elimination of waste (muda)
- continuous improvement processes including implementation, monitoring and evaluation strategies for a whole organisation and its value stream
- difference between breakthrough improvement and continuous improvement
- organisational goals, processes and structure
- approval processes within organisation
- cost/benefit analysis methods
- methods of determining the impact of a change
- advantages and disadvantages of communication media, methods and formats for different messages and audiences
- customer perception of value
- define, measure, analyse, improve, and control and sustain (DMAIC) process

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p><b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b></p>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• critically review current continuous improvement processes</li> <li>• establish ongoing review of continuous improvement processes</li> <li>• implement improvements in the practice of continuous improvement</li> <li>• better align internal and external systems</li> <li>• gather data through interviews with stakeholders</li> <li>• review existing data</li> <li>• obtain additional data through a variety of techniques</li> <li>• communicate and negotiate at all levels within the organisation</li> </ul>
<p><b>Context of and specific resources for assessment</b></p>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p>

	<p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning for appropriate portions</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the

performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used</p>
<b>Health, safety and environment</b>	<p>All changes implemented are expected to be at least</p>

<b>(HSE)</b>	neutral, or preferably beneficial, in their impact on HSE
<b>Organisation systems</b>	<p>Organisation systems may include:</p> <ul style="list-style-type: none"> <li>• problem recognition and solving</li> <li>• operational/process improvement</li> <li>• improvement projects</li> <li>• product/process design and development</li> <li>• processes for making incremental improvements</li> </ul>
<b>Relevant metrics</b>	<p>Relevant metrics include all those measures which might be used to determine the performance of the improvement system and may include:</p> <ul style="list-style-type: none"> <li>• hurdle rates for new investments</li> <li>• KPIs for existing processes</li> <li>• quality statistics</li> <li>• delivery timing and quantity statistics</li> <li>• process/equipment reliability ('uptime')</li> <li>• incident and non-conformance reports</li> <li>• complaints, returns and rejects</li> </ul>
<b>Improvement process yield</b>	<p>Improvement process yield may be regarded as:</p> <ul style="list-style-type: none"> <li>• the benefit achieved for the effort invested</li> </ul>
<b>Breakthrough improvements</b>	<p>Breakthrough improvements include:</p> <ul style="list-style-type: none"> <li>• those which result from a kaizen blitz or other improvement project or event and are a subset of all improvements</li> </ul>
<b>Timing of breakthrough improvements</b>	<p>Timing of breakthrough improvements includes:</p> <ul style="list-style-type: none"> <li>• frequency (which should be maximised) and duration (which should be minimised) of events/projects</li> </ul>
<b>Continuous improvement</b>	<p>Continuous improvement is part of normal work and does not require a special event to occur (although may still require authorisations) and contrasts with breakthrough improvement/kaizen blitz which occurs by way of an event or project</p>
<b>Resources for improvement</b>	<p>Resources for improvements include:</p> <ul style="list-style-type: none"> <li>• improvement budget</li> <li>• guidelines for trialling of possible improvements</li> <li>• mechanism for approvals for possible improvements</li> <li>• business case guidelines for proposed improvements</li> <li>• indicators of success of proposed improvement</li> <li>• mechanisms for tracking and evaluation of changes</li> </ul>

	<ul style="list-style-type: none"> <li>• forum for the open discussion of the results of the implementation</li> <li>• mechanisms for the examination of the improvement for additional improvements</li> <li>• organisation systems to sustain beneficial changes</li> </ul>
<b>Capturing value stream improvements</b>	<p>Capturing value stream improvements includes:</p> <ul style="list-style-type: none"> <li>• revised contractual arrangements</li> <li>• revised specifications</li> <li>• signed agreements</li> <li>• other documented arrangements which formalise the raised base line</li> </ul>
<b>Systems impacting improvements</b>	<p>Systems which impact/are impacted on improvements and the improvement system include:</p> <ul style="list-style-type: none"> <li>• office</li> <li>• purchasing</li> <li>• rewards (individual or team at all levels)</li> <li>• sales</li> <li>• marketing</li> <li>• maintenance</li> <li>• process/product</li> <li>• transport and logistics</li> </ul>
<b>Organisational knowledge</b>	<p>Organisational knowledge should:</p> <ul style="list-style-type: none"> <li>• be able to be quantified or otherwise modified to make its outcomes measurable or observable</li> <li>• be able to be expressed in an accessible and distributable form appropriate to the organisation operations and stakeholders</li> </ul>
<b>Improvements</b>	<p>Improvements may:</p> <ul style="list-style-type: none"> <li>• be to process, plant, procedures or practice</li> <li>• include changes to ensure positive benefits to stakeholders are maintained</li> </ul>
<b>Manager</b>	<p>Manager may include:</p> <ul style="list-style-type: none"> <li>• any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li> </ul>

## Unit Sector(s)

Unit sector Competitive systems and practices

## Custom Content Section

Not applicable.



# MSS408007A Develop problem solving capability of an organisation

## Modification History

New unit, superseding MSACMG807A Develop problem solving capability of a manufacturing organisation - Not equivalent

## Unit Descriptor

This unit of competency covers the skills and knowledge required to develop problem solving skills of individuals within an organisation and as a consequence the problem solving capability of the organisation as a whole. The unit does not supply the skills to undertake formal problem solving on individual problems.

## Application of the Unit

This unit is intended for organisation leaders/managers and people with a similar sphere of influence and scope of authority and responsibility. It applies where problem solving is already routine in the organisation and improving individual and organisational problem solving capability has been accepted as part of the organisation's improvement processes.

The unit applies to individuals who are already familiar with formal problem solving processes. Where this is not the case the following units may be completed to supply the necessary skills:

- *MSS402080A Undertake root cause analysis*
- *MSAPMSUP390A Use structured problem solving tools.*

For high level complex problem solving skills refer to *MSS407012A Lead a problem solving process to determine and solve root cause.*

This unit may also be applied to service organisations applying competitive systems and practices principles.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

Not applicable.

## Employability Skills Information

This unit contains employability skills.

### Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

### Elements and Performance Criteria

1	Develop an appropriate organisational framework	1.1	Determine or review available problem finding strategies in the organisation
		1.2	Analyse the current selection and application of problem solving tools and gauge effectiveness
		1.3	Determine preferred problem solving strategies for the organisation
		1.4	Determine or review the desired outcomes from use of selected problem solving strategies
		1.5	Review organisational structure to facilitate improvement in problem solving
		1.6	Develop a training strategy to improve problem solving ability
		1.7	Develop reporting framework and guidelines
		1.8	Develop corrective action identification and tracking systems
		1.9	Obtain support from relevant process/system owners for proposed changes
2	Improve problem	2.1	Implement training strategy

solving ability	2.2	Ensure problem solving occurs using groups or teams
	2.3	Provide resources to ensure problem solving occurs
	2.4	Confirm with teams and groups that training and resources deliver capability to solve complex problems
	2.5	Monitor problem solving to determine if improvement in developing problem solving solutions is achieved
	2.6	Provide resources to ensure solutions are implemented
	2.7	Ensure reporting and corrective action tracking occurs
3 Review problem solving effectiveness	3.1	Review corrective action tracking
	3.2	Determine benefit/cost from solutions
	3.3	Analyse interactions of multiple problems with each other and the organisation
	3.4	Review problem solving strategy
	3.5	Make improvements to problem solving strategy and approach

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- reviewing current operations and procedures to determine if problems are being identified as early as possible
- reviewing current operations and procedures to determine if problems are being defined appropriately
- identifying and quantifying desired outcome from improved problem solving capability, such as:
  - improved customer service and delivery
  - defect elimination
  - capacity improvement

- cost reduction
- safety improvement
- improved complaint resolution
- establishing appropriate reporting arrangements for formal problem solving, including:
  - appropriate metrics (e.g. incident frequency and incident consequences)
  - trigger criteria for conducting problem solving activity
  - problem definition and quantification
  - cause and effect diagrams (or similar)
- solutions identified
- reviewing organisational structure, value stream and customer alignment in order to set performance indicators for organisation problem solving capability

## Required knowledge

Required knowledge includes:

- competitive systems and practices principles
- competitive systems and practices at both a strategic and tools level, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - breakthrough improvement and continuous improvement (kaizen and kaizen blitz)
  - setting of key performance indicators (KPIs)/metrics
  - identification and elimination of waste (muda)
  - six sigma and lean six sigma
- a range of problem solving methodologies, including:
  - cross-functional problem solving team
  - cross-functional nominal group (virtual team)
  - consulting and or brainstorming with members from outside the organisation on some basis
  - input from other members of the value stream
  - the use of known/proprietary problem solving approaches or some synthesis of methods
  - own or commissioned research either in whole or in part
- organisation strategy and vision, value stream and value as defined by the organisation's customers
- corrective action tracking methods

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"> <li>• analyse and improve problem finding capabilities of the organisation</li> <li>• improve the problem solving capability of the organisation</li> <li>• set KPIs for organisation problem solving</li> <li>• ongoing review of systems and processes relevant to problem solving</li> <li>• increasing problem solving capability through identification of appropriate strategies, including where required, identifying:               <ul style="list-style-type: none"> <li>• training needs in problem finding and solving</li> <li>• changes in organisational structure, decision making and processes</li> <li>• appropriate metrics</li> <li>• need for outside assistance.</li> </ul> </li> </ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"> <li>• workplace procedures and plans relevant to work area</li> <li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li> <li>• documentation and information in relation to production, waste, overheads and hazard control/management</li> <li>• reports from supervisors/managers</li> <li>• case studies and scenarios to assess responses to contingencies.</li> </ul>
<b>Method of assessment</b>	<p>A holistic approach should be taken to the assessment.</p> <p>Competence in this unit may be assessed by using a</p>

	<p>combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence.</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as Systems Control and Data Acquisition (SCADA) software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> <li>• statistical process control systems, including six</li> </ul>
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	<p>sigma and three sigma</p> <ul style="list-style-type: none"> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Codes of practice/standards</b>	Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used
<b>Health, safety and environment (HSE)</b>	All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE
<b>Organisational structure</b>	<p>A review of organisational structure may include:</p> <ul style="list-style-type: none"> <li>• operational and support functions and departments</li> <li>• links with value stream members</li> <li>• super-users and facilitators</li> <li>• roles and responsibilities with regard to problem solving</li> <li>• plans to broaden the users of problem solving approach</li> <li>• plans to improve the problem solving performance of personnel</li> </ul>
<b>Problem finding strategies</b>	Problem finding strategies are the strategies used to identify:

	<ul style="list-style-type: none"> <li>• problems before they become obvious or cause significant non-conformance or risk</li> <li>• situations not initially considered a problem but which may be hindering greater performance</li> <li>• strategies for finding opportunities for improvement</li> </ul>
<b>Complex problem</b>	<p>A complex problem may be described as one which has several of the following characteristics:</p> <ul style="list-style-type: none"> <li>• requires going into the extended value stream for data/information</li> <li>• is wider than just applying to a single job</li> <li>• applies to less common solutions or problems</li> <li>• requires a higher level of knowledge and skill (which may or may not be possessed directly by the person solving the problem), such as:             <ul style="list-style-type: none"> <li>• significant specialist knowledge</li> <li>• significant specialist skill</li> <li>• more theory/understanding of technology or process</li> </ul> </li> <li>• data is not easily available and may need particular strategies to obtain, such as:             <ul style="list-style-type: none"> <li>• overcoming resistance from people, including employees, customers or suppliers</li> <li>• extracting data not regularly reported from SCADA or similar systems</li> <li>• the problem and/or proposed solutions require reporting or authorisations from a Board or external authorities, such as licensing or regulatory bodies</li> </ul> </li> </ul>
<b>Effective solutions</b>	<p>Effective solutions will:</p> <ul style="list-style-type: none"> <li>• prevent recurrence</li> <li>• be within the control/ability of the organisation to implement</li> <li>• meet organisation goals and objectives</li> </ul>
<b>Required resources</b>	<p>Required resources may include:</p> <ul style="list-style-type: none"> <li>• plant</li> <li>• data processing equipment</li> <li>• measuring and diagnostic equipment</li> <li>• materials (e.g. raw materials, components, work in progress, other consumables, paper and forms in electronic or hard format)</li> <li>• energy (e.g. heating, cooling, fuel and power)</li> <li>• appropriately skilled people as employees and in the</li> </ul>



	<p>value stream</p> <ul style="list-style-type: none"><li>• finances</li><li>• feedback/visual operations resources</li><li>• measuring equipment</li></ul>
<b>Manager</b>	<p>Manager may include:</p> <ul style="list-style-type: none"><li>• any person who may have either a permanent or an ad hoc role in facilitating the function of multiple teams in a workplace, departments or entire organisations</li></ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# **MSS408008A Analyse data for relevance to organisational learning**

## **Modification History**

New unit, superseding MSACMG800A Analyse data for relevance to organisational learning - Equivalent

## **Unit Descriptor**

This unit of competency covers the skills and knowledge required to analyse data generated from formal information monitoring and management systems, such as statistical process control (SPC) and six sigma, or Systems Control and Data Acquisition (SCADA) software and determining its relevance for organisational learning.

## **Application of the Unit**

This unit is intended for managers, team leaders and people with a similar sphere of influence and scope of authority and responsibility. It covers the capturing of knowledge from data generated within organisation systems and takes a largely quantitative view of information. The unit applies to individuals who are familiar with the application and use of statistics in operations. Where this is not the case the unit *MSS404052A Apply statistics to operational processes* may be completed to supply the necessary skills.

For a more qualitative approach of capturing and analysing data and applying the knowledge deduced from that to organisational learning see *MSS407008A Capture learning from daily activities in an organisation*.

This unit may also be applied to service organisations applying competitive systems and practices principles.

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

Not applicable.

## **Employability Skills Information**

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

1	Identify learning from own organisation data	1.1	Obtain data from appropriate data systems
		1.2	Examine data for discontinuities, trends and other possible signs of assignable cause
		1.3	Examine selected data events to determine root causes of data events
		1.4	Communicate root causes of data events to relevant stakeholders
2	Identify learning from value stream data	2.1	Identify data which is or could be available from other value stream members
		2.2	Identify data which might be useful but is not available and seek access to it
		2.3	Obtain and examine available data for discontinuities, trends and other possible signs of assignable cause
		2.4	Examine selected data events to determine root causes of data events in liaison with appropriate value stream personnel
		2.5	Communicate root causes of data events to relevant stakeholders
3	Capture learning	3.1	Review root causes to determine implications for organisational learning

- |   |                                     |     |  |
|---|-------------------------------------|-----|--|
|   |                                     | 3.2 | Ensure learning is captured by organisation's systems  |
|   |                                     | 3.3 | Obtain involvement and required approvals from relevant process/system owners                            |
|   |                                     | 3.4 | Check that learning flows to all relevant stakeholders   |
| 4 | Apply learning to team/organisation | 4.1 | Review management systems for their impact on organisational learning                                    |
|   |                                     | 4.2 | Brief relevant process/system owners on changes and obtain required approvals                            |
|   |                                     | 4.3 | Check learning is used in daily operations   |
|   |                                     | 4.4 | Review use of learning in liaison with appropriate value stream personnel and update in knowledge system |
|   |                                     | 4.5 | Identify implications for training and procedures  |
|   |                                     | 4.6 | Recommend improvements to value stream/organisation knowledge system                                     |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

Required skills include:

- undertaking self-directed problem solving and decision-making
- communicating across all levels in an organisation
- preparing reports and recommendations
- researching and collating data from a variety of organisation systems and sources, including:
  - data presented at tool box and other regular team, section and area meetings
  - data available through ad hoc discussions/meetings with team members, sales and marketing employees, other employees, value stream members, regulators and visitors
  - data available from interviews with employees and external organisation representatives
  - operations records which may include data from:
    - clip boards on the line
    - problem solving templates

- procedures templates
- whiteboards or other noticeboards
- computers or terminals that allow access to data bases and other electronic records
- maintenance records
- quality records
- warranty and other returns
- data from continuous improvement and breakthrough improvement activities (kaizen and kaizen blitz)
- complaints from customers, employees and members of the community
- equipment down time/maintenance records
- non-obvious sources
- determining significant data correlations and changes from those which may coincidentally be chronologically correlated
- analysing data-related problems and events to root cause
- determining value of data for organisational learning, including establishing procedures for monitoring effectiveness of improvement actions based on data
- capturing learning through paper-based, electronic or other means (e.g. film and video)

## Required knowledge

Required knowledge includes:

- competitive systems and practices tools, including:
  - value stream mapping
  - 5S
  - Just in Time (JIT)
  - mistake proofing
  - process mapping
  - establishing customer pull
  - kaizen and kaizen blitz
  - setting of key performance indicators (KPIs)/metrics
  - identification and elimination of waste (muda)
- organisational goals, strategies, operations and processes
- continuous improvement strategies and processes
- communication methods using arrange of media
- root cause analysis (RCA)
- mathematics and statistics
- expected range of performance for operations and processes, including any KPIs
- types of knowledge capture and retrieval systems used in the organisation and their applicability, including where used:
  - SPC processes

- six sigma processes
- quality processes
- plant instrumentation and control data (e.g. SCADA) systems

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<b>Overview of assessment</b>	Competence must be demonstrated in the ability to recognise, extract and record learning from workplace generated data.
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<p>A person who demonstrates competency in this unit must be able to provide evidence of the ability to:</p> <ul style="list-style-type: none"><li>• sort relevant from irrelevant data, including establishing correlations</li><li>• find and collate data from less obvious sources</li><li>• translate data into information relevant to operational and improvement activities</li><li>• make ongoing additions to the learning system</li><li>• use the learning system to validate data-based improvement activities.</li></ul>
<b>Context of and specific resources for assessment</b>	<p>Assessment of performance must be undertaken in a workplace using or implementing one or more competitive systems and practices.</p> <p>Access may be required to:</p> <ul style="list-style-type: none"><li>• workplace procedures and plans relevant to work area</li><li>• specifications and documentation relating to planned, currently being implemented, or implemented changes to work processes and procedures relevant to the assessee</li><li>• documentation and information in relation to production, waste, overheads and hazard control/management</li><li>• reports from supervisors/managers</li><li>• case studies and scenarios to assess responses to contingencies.</li></ul>
<b>Method of assessment</b>	A holistic approach should be taken to the assessment.

	<p>Competence in this unit may be assessed by using a combination of the following to generate evidence:</p> <ul style="list-style-type: none"> <li>• demonstration in the workplace</li> <li>• workplace projects</li> <li>• suitable simulation</li> <li>• case studies/scenarios (particularly for assessment of contingencies, improvement scenarios, and so on)</li> <li>• targeted questioning</li> <li>• reports from supervisors, peers and colleagues (third-party reports)</li> <li>• portfolio of evidence</li> </ul> <p>In all cases it is expected that practical assessment will be combined with targeted questioning to assess underpinning knowledge.</p> <p>Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</p>
<b>Guidance information for assessment</b>	<p>Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the candidate and the work being performed.</p>

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<b>Competitive systems and practices</b>	<p>Competitive systems and practices may include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• lean operations</li> <li>• agile operations</li> <li>• preventative and predictive maintenance approaches</li> <li>• monitoring and data gathering systems, such as SCADA software, Enterprise Resource Planning (ERP) systems, Materials Resource Planning (MRP) and proprietary systems</li> </ul>
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	<ul style="list-style-type: none"> <li>• statistical process control systems, including six sigma and three sigma</li> <li>• JIT, kanban and other pull-related operations control systems</li> <li>• supply, value, and demand chain monitoring and analysis</li> <li>• 5S</li> <li>• continuous improvement (kaizen)</li> <li>• breakthrough improvement (kaizen blitz)</li> <li>• cause/effect diagrams</li> <li>• overall equipment effectiveness (OEE)</li> <li>• takt time</li> <li>• process mapping</li> <li>• problem solving</li> <li>• run charts</li> <li>• standard procedures</li> <li>• current reality tree</li> </ul> <p>Competitive systems and practices should be interpreted so as to take into account:</p> <ul style="list-style-type: none"> <li>• the stage of implementation of competitive systems and practices</li> <li>• the size of the enterprise</li> <li>• the work organisation, culture, regulatory environment and the industry sector</li> </ul>
<b>Data systems</b>	<p>Data systems are to include:</p> <ul style="list-style-type: none"> <li>• health, safety and environment (HSE) and maintenance systems along with process and quality systems</li> </ul>
<b>Codes of practice/standards</b>	<p>Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used</p>
<b>HSE</b>	<p>All changes implemented are expected to be at least neutral, or preferably beneficial, in their impact on HSE</p>
<b>Data</b>	<p>Data may come from any or all of a range of internal and value stream sources, including:</p> <ul style="list-style-type: none"> <li>• SPC processes</li> <li>• six sigma processes</li> <li>• quality processes</li> <li>• plant instrumentation and control data</li> </ul>
<b>• Causes of data events</b>	<p>Data events need to be analysed to separate causes of</p>



	changes in data from those which may coincidentally be chronologically correlated
<b>Performance not to expectation/norm</b>	Performance outside the normal range (good or bad) may be expected to have an assignable cause which when identified can add to knowledge
<b>Other value stream members</b>	Other value stream members includes: <ul style="list-style-type: none"> <li>• internal and external suppliers and customers</li> </ul>
<b>Learning</b>	Learning is something which can be passed on and is a recordable event or method which leads to change in practice
<b>Systems for the capture of knowledge</b>	Systems for the capture of knowledge may be paper based electronic or other and may include: <ul style="list-style-type: none"> <li>• clip boards on the line</li> <li>• problem solving templates</li> <li>• procedures templates</li> <li>• whiteboards/other noticeboards</li> <li>• databases and other electronic records</li> <li>• incident reports</li> <li>• maintenance requests</li> </ul> They may have as part of them a method of knowledge retrieval and possibly of searching, filing and cataloguing
<b>Record</b>	Appropriate records include systems which ensure knowledge: <ul style="list-style-type: none"> <li>• is not just retained by an individual</li> <li>• is available to others</li> <li>• survives beyond the departure of individual</li> <li>• has an allocated a level of importance</li> </ul>
<b>Stakeholders</b>	Stakeholders may include: <ul style="list-style-type: none"> <li>• work team members</li> <li>• value stream members</li> </ul>

## Unit Sector(s)

Unit sector

Competitive systems and practices

## Custom Content Section

Not applicable.

# PMBPROD291B Operate resin infusion moulding equipment

## Modification History

Not applicable.

## Unit Descriptor

### Unit descriptor

This competency covers the operation of resin infusion moulding equipment and the resolving of routine problems to procedure in the production process.

## Application of the Unit

### Application of this unit

This competency applies to operators who are required to undertake the routine operation of resin infusion moulding equipment. This competency is typically performed by operators working either independently or as part of a work team.

The operator:

- takes product off mould table
- checks raw material infusion
- checks product for quality and conformity to specifications
- notices any problems and takes required action (e.g. reporting)
- deals with non-conforming products, waste and scrap
- completes logs and reports.

They may record key variables such as vacuum bag conditions and production rate and reasons for interruptions.

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

### Prerequisites

This unit has **no** prerequisites.

## Employability Skills Information

### Employability Skills

The required outcomes described in this unit contain applicable Employability Skills. The Employability Skills Summary of the qualification(s) in which this unit is packaged will assist in identifying Employability Skill requirements.

### Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.

### Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.
1. Check work requirements.	1.1 Identify work requirements from procedures. 1.2 Check product, materials and equipment meet requirements for job(s). 1.3 Recognise requirements which may not be in accordance with usual practice. 1.4 Ask questions of appropriate person to confirm non standard job specifications. 1.5 Ensure housekeeping is to requirements. 1.6 Identify hazards associated with the job and take appropriate action. 1.7 Perform other pre-operational checks in accordance with procedures.
2. Conduct pre-operational checks as required.	2.1 Check safety equipment is in position and working. 2.2 Check moulds, closures and fittings to procedures. 2.3 Check moulds for cracks, chips, marks and cleanliness. 2.4 Check materials, including fibre preforms, resins,

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance Criteria describe the required performance needed to demonstrate achievement of the Element. Assessment of performance is to be consistent with the Evidence Guide.
	additives and release agents are correct. 2.5 Undertake other pre-operational checks in accordance with procedures.
3. Operate resin infusion equipment, to procedure.	3.1 Check process is operating within required limits. 3.2 Check product is in specification and to required quality standard. 3.3 Ensure product is consistently ready for next operation. 3.4 Maintain supply of material(s) as required. 3.5 Complete logs and records as required. 3.6 Collect and segregate scrap, waste and other materials as required. 3.7 Keep equipment and work area clean. 3.8 Pause infusion cycle and perform emergency stop as required.
4. Resolve routine problems, to procedure.	4.1 Recognise known faults that occur during the operation. 4.2 Identify and take action on causes of routine faults. 4.3 Log problems as required. 4.4 Identify non-routine process and quality problems and take appropriate action.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of an operational knowledge of the materials, equipment and process sufficient to recognise out of specification products, process problems and materials faults. For example, if the vacuum bag has a hole this will affect the flow of resin during infusion. Therefore care needs to be taken of the equipment to reduce damage, and resin flow should be monitored to reduce production time, if problems occur.

Knowledge of organisation procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.

Application of the knowledge of managing risks using the hierarchy of controls applied to the resin infusion process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge of and skills in the operation of resin infusion equipment and main components sufficient for consistent production of quality products including:

- production workflow sequences and materials demand
- the reasons for checking process control panels and reporting readings which do not conform to the work instructions
- accurately monitoring equipment operation and product quality
- the potential effects of variations in raw materials and equipment operation in relation to quality of product
- processing behaviour of polymers and the role of additives
- waste management and knowing the importance of re-using non-conforming products wherever possible
- correct selection and use of equipment, materials, processes and procedures
- explain the effect of unauthorised or emergency shutdown in relation to safety and production requirements
- identify factors which may affect product quality or production output and appropriate remedies.

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- identify when the operator is able to rectify faults, when assistance is required and who is the appropriate source for assistance
- identify and describe own role and role of others involved directly in the process.

### **Language, literacy and numeracy requirements**

This unit requires the ability to read and interpret typical product specifications, job sheets, procedures, material labels and safety information as provided to operators.

Writing is required to the level of completing workplace forms.

Basic numeracy is required, eg to determine that two 25 kg bags are needed to make up a requirement for 50 kg.

## **Evidence Guide**

The Evidence Guide provides advice on assessment and must be read in conjunction with the Performance Criteria, required skills and knowledge, the Range Statement and the Assessment Guidelines for this Training Package.

### **Overview of assessment**

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- apply the required skills and knowledge to operate resin infusion moulding equipment
- apply approved procedures.

Consistent performance should be demonstrated. For example, look to see that resin infusion moulding production standards are met consistently.

### **Assessment method and context**

Assessment will occur on industrial resin infusion moulding equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- by using appropriate, industrial resin infusion moulding equipment requiring demonstration of operation and emergency stop procedures
- in a situation allowing for the generation of evidence of the ability to respond to problems
- by using a suitable simulation and/or a range of case studies/scenarios
- through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The Range Statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to the operation of resin infusion moulding equipment including moulds, pumps and programmable logic controllers (PLC) if fitted. It includes the operation of all relevant additional equipment where that equipment is integral to the process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- moulds
- vacuum pumps and fittings (eg hoses and couplings)
- controller (eg PLC if fitted)
- vacuum bags
- hand tools used in the this process (eg dispensing equipment)
- material loading equipment used for loading of raw materials
- relevant personal protective equipment.

### **Hazards**

Typical hazards may include:

- spills (eg dripping of resin)
- dusts/vapours (eg resin vapours)
- slip and fall
- temperature (eg during the curing process)
- hazardous substances
- moving equipment
- manual handling hazards.

### **Problems**

'Respond to routine problems' means 'apply known solutions to a limited range of predictable problems'. Typical process problems may include:

- equipment malfunction
- vacuum leaks
- vacuum bag bridging
- vacuum switch-off timing



- stoppage of resin flow
- variations in process conditions, especially temperature
- variations affecting cure rate
- variations in materials or contamination of materials
- equipment, tool, or mould damage.

Typical product problems may include:

- dry spots
- resin pooling
- under-saturation of resin
- poor surface finish
- routine product faults
- variations in materials and/or contamination of materials.

Appropriate action for non-routine problems may be reporting to designated person or other action specified in the procedures.

## **Unit Sector(s)**

Not applicable.

# PMBPROD294B Operate resin transfer moulding equipment

## Modification History

Not applicable.

## Unit Descriptor

### Unit descriptor

This competency covers the operation of resin transfer moulding equipment and the resolving of routine problems to procedure.

## Application of the Unit

### Application of this unit

This competency applies to operators who are required to undertake the routine operation of resin transfer moulding equipment for the production of composites.

It is typically performed by operators working either independently or as part of a work team.

The operator will:

- check product for quality and conformity to specifications
- check materials are correct
- notice any problems and take required action (e.g. reporting)
- deal with non-conforming products, waste and scrap.
- complete logs and reports.

They may record key variables such as machine conditions and production rate and reasons for interruptions.

These unit does not include :

- packing of product - see *MSASUP204A Pack products or materials*
- finishing of product - see *PMBFIN201 Finish products and components*
- 

## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

### Prerequisites

This unit has **no** prerequisites.

## Employability Skills Information

### Employability Skills

The required outcomes described in this unit contain applicable Employability Skills. The Employability Skills Summary of the qualification(s) in which this unit is packaged will assist in identifying Employability Skill requirements.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Check work requirements.	1.1 Identify work requirements from production plan or request. 1.2 Check product, materials and equipment meet requirements for job/s. 1.3 Recognise requirements which may not be in accordance with usual practice. 1.4 Ask questions of appropriate person to confirm non standard job specifications. 1.5 Ensure housekeeping is to requirements. 1.6 Identify hazards associated with the job and take appropriate action. 1.7 Undertake other pre-operational checks in

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	accordance with procedures.
2. Conduct pre-operational checks as required.	2.1 Check safety equipment is in position and working. 2.2 Check moulds, closures and fittings to procedures. 2.3 Check moulds for cracks, chips, marks and cleanliness. 2.4 Check materials including fibre preforms, resins additives and release agents are correct. 2.5 Undertake other pre-start checks in accordance with procedures.
3. Operate equipment to procedures.	3.1 Check process is operating within required limits. 3.2 Check product is in specification and to required quality standard. 3.3 Maintain supply of material(s) as required. 3.4 Complete logs and records as required. 3.5 Collect and segregate scrap, waste and other materials as required. 3.6 Complete logs and records as required. 3.7 Keep equipment and work area clean. 3.8 Pause cycle or stop equipment in an emergency, as required.
4. Resolve routine problems.	4.1 Recognise known faults that occur during the operation. 4.2 Identify and take action on causes of routine faults. 4.3 Log problems as required. 4.4 Identify non-routine problems and report to designated person.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of knowledge of the materials, equipment and process sufficient to recognise out of specification products, process problems and materials faults.

Knowledge and ability to implement organization procedures and relevant regulatory requirements; within appropriate time constraints and work standards.

Application of knowledge of managing risks using hierarchy of controls applied to the resin transfer moulding process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge and skills in the operation of resin transfer moulding process and equipment sufficient for consistent production of quality products including:

- production workflow sequences and materials demand
- reasons for checking process control panels and reporting readings which do not conform to the work instructions
- correct selection and use of equipment, materials, processes and procedures
- accurately monitoring equipment operation and product quality
- potential effects of variations in raw materials and equipment operation in relation to quality of product
- processing behaviour of polymers and the role of additives
- waste management and knowing the importance of re-using non-conforming products wherever possible
- effects of unauthorised or emergency shutdown in relation to safety and production requirements
- identifying factors which may affect product quality or production output and appropriate remedies.

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- identify when the operator is able to rectify faults, when assistance is required and who is the appropriate source for assistance
- identify and describe own role and role of others involved directly in the resin transfer moulding process.

### **Language, literacy and numeracy requirements**

This unit requires the ability to read and interpret typical product specifications, job sheets, procedures, material labels, basic machine control panels, and safety information as provided to operators.

Writing is required to the level of completing workplace forms.

Numeracy is required to the level of reading tables of figures and graphs (and applying the resultant information), using formula percentages/ratios to determine the required mass of an additive (catalyst, pigment etc.) for a given amount of resin, and similar manipulations and interpretation.

## **Evidence Guide**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### **Overview of assessment**

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- apply the required skills and knowledge to operate resin transfer moulding equipment
- apply approved procedures

Consistent performance should be demonstrated. For example, look to see that:

- resin transfer moulding production standards are met consistently
- all safety procedures are followed

### **Assessment method and context**

Assessment will occur on a resin transfer moulding equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- by using appropriate resin transfer moulding equipment requiring demonstration of operation and emergency stop procedures
- in a situation allowing for the generation of evidence of the ability to respond to problems
  - by using a suitable simulation and/or a range of case studies/scenarios
  - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to all resin transfer moulding operations within the plastics and rubber sectors. It includes the operation of all relevant additional equipment integral to the process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- resin transfer moulding equipment such as moulds, resin pumps and fittings
- components of resin transfer moulding equipment such as closures, couplings, hoses, breathers, bleeders
- controller (such as PLC), if fitted
- hand tools used in this process
- material loading equipment used for loading of raw materials
- relevant personal protective equipment.

### **Hazards**

Typical hazards include:

- spills
- dusts/vapours
- slip and fall
- temperature
- hazardous substances
- moving equipment
- manual handling hazards.

## **Problems**

'Respond to routine problems' means apply known solutions to a limited range of predictable problems. Typical process and product problems may include:

- resin, over or undersupplied to mould
- equipment malfunction
- variations in process conditions, especially temperature variations affecting cure rate
- variations in materials or contamination of materials
- equipment, tool or mould damage
- routine product faults
- mould/tooling problems.

Appropriate action for non-routine problems may be reporting to designated person or other action specified in the procedures.

## **Variables**

Key variables to be monitored include:

- operating temperatures
- cycle time
- output rate
- surface finish and condition
- product weight
- product integrity and general conformance to specification/ sample.
- 

## **Unit Sector(s)**

Not applicable.



# **PMBPROD298B Operate equipment using pre-preg material**

## **Modification History**

Not applicable.

## **Unit Descriptor**

### **Unit descriptor**

This competency covers the operation of equipment using pre-preg materials to produce composite products and the resolving of routine problems to procedure in the production process.

This competency is typically performed by operators working either independently or as part of a work team.

## **Application of the Unit**

### **Application of this unit**

This competency applies to operators who are required to undertake the routine operation of equipment using pre-preg materials. The key factors are the making of products to meet quality standards and workplace requirements.

It includes:

- checking job sheets for work requirements
- following approved hazard minimisation procedures for any hazards connected with materials and process, using work instructions, labels and materials safety data sheets, and in accordance with occupational health and safety legislative responsibilities
- monitoring equipment operation and reporting process variations
- checking product for quality and conformity to specifications
- discarding non-conforming products ensuring discarded materials are reused where possible and waste and scrap is disposed of in accordance with workplace instructions
- identifying and taking action on routine process problems
- completing logs and reports.
- 

## **Licensing/Regulatory Information**

Not applicable.

## Pre-Requisites

### Prerequisites

This unit has **no** prerequisites.

## Employability Skills Information

### Employability Skills

The required outcomes described in this unit contain applicable Employability Skills. The Employability Skills Summary of the qualification(s) in which this unit is packaged will assist in identifying Employability Skill requirements.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Check work requirements.	1.1 Identify work requirements from procedures. 1.2 Identify product, materials and equipment requirements for job(s). 1.3 Recognise hazards and adopt steps required to ensure safety. 1.4 Check with supervisor/appropriate person if requirements are not in accordance with usual practice.
2. Conduct pre-start checks as required.	2.1 Check safety gates and guards are in position and working. 2.2 Check moulds, closures and fittings to procedures.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	2.3 Check moulds for cracks, chips, marks and cleanliness. 2.4 Check pre-preg materials and other raw materials are correct. 2.5 Undertake other pre-start checks in accordance with procedures.
3. Operate equipment.	3.1 Start equipment safely and correctly when required. 3.2 Check process is within required limits. 3.3 Collect products and store as required. 3.4 Check product/process is in specification/to required quality standard. 3.5 Maintain supply of material(s) as required. 3.6 Complete logs and records when required. 3.7 Collect and reprocess/discard scrap/trim, waste and other materials in accordance with procedures. 3.8 Clean up equipment and work area in accordance with procedures. 3.9 Pause or stop equipment in an emergency, following workplace and emergency procedures.
4. Respond to routine problems to procedures.	4.1 Recognise known faults that occur during the operation. 4.2 Identify and take action on causes of routine faults. 4.3 Log problems as required. 4.4 Identify non-routine process and quality problems and take appropriate action.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of knowledge of the materials, equipment and process sufficient to recognise out of specification products, process problems and materials faults.

Knowledge of organization procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.

Application of the knowledge of managing risks using the hierarchy of controls applied to equipment using pre-preg materials. Application of approved hazard control, safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge of and skills in the operation of equipment using pre-preg materials and main components sufficient for consistent production of quality products including:

- operation of moulding equipment and components
- production workflow sequences and materials demand
- reasons for checking process control panels and reporting readings which do not conform to the work instructions
- approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and clean up
- potential effects of variations in raw materials and equipment operation in relation to quality of product
- waste management and importance of reusing non-conforming products wherever possible
- correct selection and use of equipment, materials, processes and procedures
- identify factors which may affect product quality or production output and appropriate remedies.

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- monitor equipment operation and product quality
- identify when the operator is able to rectify faults, when assistance is required and who is the appropriate source for assistance
- identify and describe own role and role of others involved directly in the process
- distinguish between possible causes of routine faults.

### **Language, literacy and numeracy requirements**

This unit requires the ability to read and interpret typical product specifications, job sheets, procedures, material labels and safety information as provided to operators.

Writing is required to the level of completing workplace forms.

Numeracy is required to the level of reading tables of figures and graphs (and applying the resultant information), using formula percentages/ratios to determine the required mass of an additive(catalyst, pigment etc.) for a given amount of resin, and similar manipulations and interpretation.

## **Evidence Guide**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### **Overview of assessment**

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- recognise the importance of material properties and qualities
- apply approved procedures
- take appropriate action to resolve faults or report faults to appropriate personnel
- explain and implement emergency shutdown procedures.

Consistent performance should be demonstrated. For example, look to see that:

- production standards are met consistently
- upstream and down stream communication is timely and effective
- operating procedures and work instructions are read and interpreted correctly
- problems are identified and appropriate action is taken (ie the problem is fixed or reported)
- all safety procedures are followed.

### **Assessment method and context**

Assessment will occur using industrial pre-preg on industrial equipment and will be undertaken in a work like environment.

Competence in this unit may be assessed:

- by using an appropriate, industrial moulding machine
- in a situation allowing for the generation of evidence of the ability to respond to problems
- by using a suitable simulation and/or a range of case studies/scenarios
- through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to the operation of equipment using pre-preg materials to manufacture composite products. It includes moulds, equipment and programmable logic controllers (PLCs) if fitted.

Processes using pre-preg materials may include vacuum bagging or other closed mould processes.

It includes the operation of all relevant additional equipment where that equipment is integral to the process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- moulds
- moulding equipment and closures controllers, such as PLCs if fitted
- hand tools used in the this process
- material loading equipment used for loading of raw materials
- relevant personal protective equipment.

### **Hazards**

Typical hazards include:

- spills
- dusts/vapours
- slip and fall
- temperature
- hazardous substances

- moving equipment
- manual handling hazards.

### **Problems**

'Respond to routine problems' means 'apply known solutions to a limited range of predictable problems'. Typical process problems may include:

- equipment malfunction
- poor handling or storage of pre-preg materials
- pre-preg incorrectly applied to mould
- variations in process conditions, especially temperature
- variations affecting cure rate
- variations in materials or contamination of materials
- equipment, tool or mould damage
- incorrect quantity of materials
- contaminated materials/additives
- equipment faults
- mould damage
- wrong raw materials/additives
- incorrect quantity of materials/additives
- machine failure.

Typical product problems may include:

- routine product faults
- machine malfunction
- mould/tooling problems
- variations in materials and/or contamination of materials.
- 

### **Unit Sector(s)**

Not applicable.

# **PMBPROD391B Produce composites using resin infusion**

## **Modification History**

Not applicable.

## **Unit Descriptor**

### **Unit descriptor**

This competency covers the operation of resin infusion equipment to make composite products and the solving of problems.

## **Application of the Unit**

### **Application of this unit**

This competency is typically performed by advanced operators applying knowledge of materials, product purpose and processes to the operation of resin infusion equipment to produce products conforming to requirements. It also requires using a range of well developed skills requiring some discretion and judgement to recognise and resolve a range of problems.

The operator should:

- set up and start resin infusion equipment
- check settings and adjustments of equipment
- identify and plan own work requirements from production requests
- monitor equipment operation
- make appropriate adjustments to correct materials, equipment or process variations
- solve resin infusion equipment, material and process problems, seeking guidance where necessary or appropriate.
- 

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

### **Prerequisites**

This unit has the prerequisite of *PMBPROD291B Operate resin infusion moulding equipment*.



## Employability Skills Information

### Employability Skills

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Plan own work requirements.	1.1 Identify the most appropriate equipment to be used for production and upstream and downstream operations from production plan or request. 1.2 Identify and check materials required including additives. 1.3 Implement measures to control hazards in line with procedures and duty of care. 1.4 Identify requirements for materials, quality, production, and equipment checks.
2. Start resin infusion moulding process to procedures.	2.1 Identify process settings for required product. 2.2 Set process to required settings. 2.3 Check materials are correct. 2.4 Take appropriate action for non-conforming materials. 2.5 Set up date, batch and materials markings to specifications, as required. 2.6 Complete pre-start checks. 2.7 Start up resin infusion moulding process
3. Operate and make	3.1 Operate resin infusion equipment, noting key

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
adjustments to the resin infusion process to procedures.	variables. 3.2 Monitor controls/displays/terminals for production and process data. 3.3 Take samples as required and identify product out of specification. 3.4 Monitor product/process quality. 3.5 Make adjustments to remedy faults and non-conformity to standard as required. 3.6 Establish a stable resin infusion process. 3.7 Adjust process to minimise scrap and trim. 3.8 Clean, adjust and check equipment damage as required.
4. Shut down machine to procedures.	4.1 Determine type of shut down. 4.2 Select appropriate cleaning method. 4.3 Clean efficiently and adequately as required. 4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices. 4.5 Complete relevant documentation. 4.6 Ensure area is clean and clear after the shutdown, in readiness for the next start-up.
5. Anticipate and solve problems.	5.1 Recognise a problem or a potential problem. 5.2 Determine problems needing priority action. 5.3 Refer problems outside area of responsibility to appropriate person, with possible causes. 5.4 Seek information and assistance as required to solve problems. 5.5 Solve problems within area of responsibility. 5.6 Follow through items initiated until final resolution has occurred.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of knowledge of the materials, equipment and process sufficient to recognise material and equipment conditions which may lead to out of specification production. For example, once resin infusion begins there is very little that can be done to rectify a problem at this point. If a leak were to occur, even the smallest amount of air introduced could potentially destroy a composite part. There are some cases where problems can be corrected, but the best solution is to check and monitor equipment and set up before infusion.

Knowledge of organization procedures, quality requirements at each production stage, and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.

Application of knowledge of managing risks using the hierarchy of controls applied to the resin infusion process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Skills to identify the range of possible causes of product faults.

Knowledge as a basis for solving processing and material problems including:

- characteristics of materials and behaviour in relation to heat, pressure and time
- function and operating principles of composites forming equipment, machine components and ancillary equipment including the mechanical, hydraulic, pneumatic, electrical and electronic principles which effect machine operation
- impact of temperature, pressure, time during cycles on product quality and production output
- phases of the resin infusion composite forming cycle and the effect of the key variables on product quality, in order to make appropriate adjustments to equipment settings. For example, the vacuum is applied while reinforcements are still dry, which allows for any possible leaks to be sought out before resin is infused. If something is not sitting properly, the vacuum need only be released and readjusted. This decreases the possibility of damaged composite products.
- changes to materials at various stages of production
- waste management and importance of non-conforming materials
- impact of variations in raw materials and equipment operation in relation to final product.
- polymer properties and their interactions with process conditions
- relationships between polymer properties and process conditions
- changes to polymer properties to better suit process requirements.
- product problems related to polymer properties
- product problems related to process conditions
- adjustments to process conditions to meet polymer and product requirements

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- maintain output and product quality using appropriate instruments, controls, test information and readings
- identify and describe own role and role of others involved directly in the process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when assistance is required to solve problems.

## **Language, literacy and numeracy requirements**

This unit requires the ability to read and interpret typical product specifications, job sheets and material labels as provided to operators.

Writing is required to the level of completing workplace forms and production reports.

Numeracy is required to the level of determining required weights/volumes of materials in a resin mix for different circumstances (say using a data sheet), number of layers of impregnated matrix required to yield the required product laminate thickness, and similar activities.

## **Evidence Guide**

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### **Overview of assessment**

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Where the assessee does not currently possess evidence of competency in *PMBPROD291BOperate resin infusion moulding equipment*, it may be co-assessed with this unit.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify critical materials properties and resin infusion process variables in relation to the process requirements and the end product
- make adjustments to the process as required
- identify and take action on problems and potential problems.

Consistent performance should be demonstrated. For example, look to see that:

- the process runs consistently and smoothly, with the minimum need for human intervention
- all safety procedures are always followed.

### **Assessment method and context**

Assessment will occur on an industrial infusion moulding equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- using appropriate, industrial resin infusion equipment requiring demonstration of starting, operating and completing the composite moulding process
- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
  - by using a suitable simulation and/or a range of case studies/scenarios
  - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to manufacture of composite products using resin infusion equipment within the plastics and rubber industries.

It includes all moulds, pumps and programmable logic controllers (PLCs) if fitted and all relevant ancillary equipment integral to the composites forming process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- moulds, closures and fittings
- vacuum pumps and fittings (such as couplings, hoses, breathers, bleeders)
- additional equipment (such as resin bucket, resin line holder, zip-strips)
- controller (such as PLC if fitted)
- relevant personal protective equipment (PPE)
- hand tools used in the production process (such as clamps to stop resin moving up vacuum hose)
- ancillary materials (such as release films and fabrics, sealant tapes, preforms, cores, and pre-pregs)
- material loading equipment used for loading of raw materials.

### **Hazards**

Typical hazards include:

- hazardous vapours and materials
- fibres, airborne and handled
- humidity, air temperatures, radiant heat, hot moulds
- stationary and moving machinery, parts and components
- manual handling hazards.

### **Problems**

'Anticipate and solve problems' means resolve a wide variety of routine and non-routine problems, using product and process knowledge to develop solutions to problems which do not have a known solution/ a solution recorded in the procedures.

Typical routine faults may include:

- resin pooling
- under-saturation of resin
- dry reinforcements not sitting flat
- leaks in vacuum bag
- poor colour dispersion
- poor surface finish
- dry spots
- vacuum switch-off timing incorrect.

Non-routine faults which may have multiple causes include:

- mould release problems
- stoppage of resin flow
- excess resin
- warping or cracking after moulding
- variations in vacuum

- variations affecting cure rate.

Typical process and product problems may include:

- resin, over or under supplied to mould
- release agents performance
- contamination
- temperature variations, affecting resin cure-rate
- blemishes
- missing detail
- warped moulds or dies
- worn or damaged mould parts or fittings
- variations in materials and/or contamination of materials.

Appropriate action for problems outside of area of responsibility may be reporting to an appropriate person.

Appropriate action for solving problems within area of responsibility includes asking questions and seeking assistance from appropriate persons/sources.

### **Variables**

Key variables to be monitored include:

- operating temperatures
- cycle time (such as the resin filling time)
- output rate
- vacuum pressure
- surface finish and condition
- equipment - adjustments/setup
- product weight
- product integrity and general conformance to specification/sample.
- 

### **Unit Sector(s)**

Not applicable.

# **PMBPROD394B Produce composites using resin transfer moulding**

## **Modification History**

Not applicable.

## **Unit Descriptor**

### **Unit descriptor**

This competency covers the operation and adjustment of resin transfer moulding processes and the solving of problems.

## **Application of the Unit**

### **Application of this unit**

This competency is typically performed by advanced operators applying knowledge of materials, product purpose and processes to the operation of resin transfer moulding equipment for the production of composites. It also requires using a range of well developed skills requiring some discretion and judgment to recognize and resolve a range of problems.

The operator will:

- start up resin transfer moulding equipment
- check materials for conformity to job requirements
- make appropriate adjustments to correct materials, equipment or process variations
- solve resin transfer moulding equipment, material and process problems, seeking guidance where necessary or appropriate
- 

## **Licensing/Regulatory Information**

Not applicable.

## **Pre-Requisites**

### **Prerequisites**

This unit has the prerequisite of *PMBPROD294B Operate resin transfer moulding equipment*.



## Employability Skills Information

### Employability Skills

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Plan own work requirements.	1.1 Identify the most appropriate equipment to be used for production and upstream and downstream operations from production plan or request. 1.2 Identify and check materials required including additives. 1.3 Implement measures to control identified hazards in line with procedures and duty of care. 1.4 Identify requirements for materials, quality, production and equipment checks.
2. Start up resin transfer moulding process to procedures.	2.1 Identify process settings required for the product. 2.2 Adjust control panel (eg, cycle time, heating, cooling) as required for factors such as temperature, material. 2.3 Check materials, resins, fibres, cores are correct. 2.4 Take appropriate action for non-conforming materials. 2.5 Set up date, batch and materials markings to specifications, as required. 2.6 Complete pre-start checks.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	2.7 Start up process.
3. Operate and make adjustments as required to the resin transfer moulding process to procedures.	3.1 Operate resin transfer moulding process, noting key variables. 3.2 Monitor controls/displays/terminals for production/process data. 3.3 Monitor product/process quality, thickness and integrity to procedures. 3.4 Take samples as required and identify product out of specification. 3.5 Make adjustments to remedy faults and nonconformity to standard, as required. 3.6 Establish a stable resin transfer moulding process. 3.7 Adjust process to minimise scrap and waste. 3.8 Clean, adjust and lubricate equipment as required.
4. Shut down machine to procedures.	4.1 Determine type of shutdown. 4.2 Select appropriate purging method. 4.3 Purge efficiently and adequately as required. 4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices. 4.5 Complete relevant documentation. 4.6 Ensure area is clean and clear after the shutdown, in readiness for the next start-up.
5. Anticipate and solve problems.	5.1 Recognise a problem or anticipate potential problems. 5.2 Determine problems needing priority action. 5.3 Refer problems outside area of responsibility to appropriate person, with possible causes. 5.4 Seek information and assistance as required to solve problems. 5.5 Solve problems within area of responsibility. 5.6 Follow through items initiated until final resolution has occurred.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of knowledge of the materials, equipment and process sufficient to recognise material and equipment conditions which may lead to out of specification production.

Knowledge of organization procedures, quality and safety requirements at each production stage and relevant regulatory requirements; and the ability to implement them within appropriate time constraints and work standards.

Application of the knowledge of managing risks using the hierarchy of controls applied to the resin transfer moulding process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge as a basis for problem solving process and material problems, including:

- characteristics of materials and behaviour in relation to heat, pressure, flow rate and time
- function and operating principles of resin transfer moulding equipment, machine components and ancillary equipment, including the mechanical, hydraulic, pneumatic, electrical and electronic principles which affect machine operations
- impact of machine speed, temperature, pressure, time during cycles on product quality and production output
- impact of variations in raw material and equipment operation in relation to the final product
- changes to materials at various stages of production
- waste management and significance of non-conforming materials
- polymer properties and their interactions with process conditions
- relationships between polymer properties and process conditions
- changes to polymer properties to better suit process requirements
- product problems related to polymer properties
- product problems related to process conditions
- adjustments to process conditions to meet polymer and product requirements.

Competence also includes the ability to :

- plan own work, including predicting consequences and identifying improvements
- maintain output and product quality using appropriate instruments, controls, test information and readings
- identify and describe own role and role of others involved directly in the process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when assistance is required to solve problems.

Knowledge and ability to identify and take appropriate action on the range of possible causes of product faults.

### Language, literacy and numeracy requirements

This unit requires the ability to read and interpret typical product specifications, job sheets, material labels, and machine control panels such as those displaying PLC information, if fitted.

Writing is required to the level of completing workplace forms, quality assurance records and production reports.

Numeracy is required to the level of determining required weights/volumes of materials in a resin mix for different circumstances (say using a data sheet), number of layers of impregnated matrix required to yield the required product laminate thickness, and similar activities.

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### Overview of assessment

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Where the assessee does not currently possess evidence of competency in *PMBPROD294B Operate resin transfer moulding equipment*, it may be co-assessed with this unit.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify critical materials properties and composites moulding process characteristics in relation to the process requirements and the end product
- identify and take appropriate action on problems and potential problems.

Consistent performance should be demonstrated. For example, look to see that:

- the process runs smoothly, with the minimum need for intervention
- all safety procedures are always followed.

### Assessment method and context

Assessment will occur on an industrial resin transfer moulding equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- using appropriate resin transfer moulding equipment requiring demonstration of start-up, operation and shutdown procedures

- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
  - by using a suitable simulation and/or a range of case studies/scenarios
  - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to all resin transfer moulding within the plastics and rubber industries. It includes the operation of all relevant additional equipment integral to the composites forming process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- resin transfer moulding equipment such as moulds, resin pumps and fittings
- components of resin transfer moulding equipment such as closures, couplings, hoses, breathers, bleeders
- controller, such as PLC if fitted
- relevant personal protective equipment (PPE)
- hand tools used in the production process
- material loading equipment used for loading of raw materials.

## **Hazards**

Typical hazards include:

- hazardous vapours and materials
- fibres, airborne and handled
- humidity, air temperatures, radiant heat, hot moulds
- stationary and moving machinery, parts and components
- manual handling hazards.

## **Problems**

'Anticipate and solve problems' means resolve a wide range of routine and non-routine problems, using product and process knowledge to develop solutions to problems which do not have a known solution/s recorded in the procedures.

Typical process and product problems may include:

- resin, over or undersupplied to mould
- release agents performance
- contamination
- temperature variations, affecting resin cure-rate
- blemishes
- missing detail
- warped moulds or dies
- worn or damaged mould parts or fittings
- variations in materials and/or contamination of materials
- processing problems.

Appropriate action for problems outside of area of responsibility may be reporting to an appropriate person.

Appropriate action for problems within of area of responsibility includes asking questions and seeking assistance from appropriate persons/sources.

## **Variables**

Key variables to be monitored include:

- operating temperatures
- cycle time
- output rate
- surface finish and condition
- product weight

- product integrity and general conformance to specification/sample.
- 

## **Unit Sector(s)**

Not applicable.

# **PMBPROD398B Produce composites using pre-pregs**

## **Modification History**

Not applicable.

## **Unit Descriptor**

### **Unit descriptor**

This competency covers the operation of equipment using pre-pregs to make composite products and the solving of non-routine problems. This competency is typically performed by advanced operators demonstrating some relevant theoretical knowledge and using a range of well developed skills requiring some discretion and judgement.

## **Application of the Unit**

### **Application of this unit**

This competency applies to advanced operators who are required to apply knowledge of materials, product purpose and processes to the operation of equipment for the production of composites using pre-pregs. The key factors are the production of material meeting quality standards and product requirements and the recognition and resolving of a range of routine and non-routine problems.

It includes:

- identifying and planning own work requirements from production requests
- identifying and minimising any hazards connected with materials and process from materials safety data sheets, labels and workplace procedures
- checking settings and adjustments of equipment
- checking materials for conformity to job requirements
- monitoring equipment operation and correcting process variations
- correcting materials, equipment or process variations and making appropriate adjustments
- discarding non-conforming products ensuring discarded materials are reused where possible and waste and scrap is disposed of in accordance with workplace instructions
- solving routine and non-routine composites production equipment and process problems, seeking guidance where necessary or appropriate
- completing logs and reports.
-



## Licensing/Regulatory Information

Not applicable.

## Pre-Requisites

### Prerequisites

This unit has the prerequisite of *PMBPROD298A Operate equipment using pre-pregs material*.

## Employability Skills Information

### Employability Skills

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Plan own work requirements.	1.1 Identify equipment and processes used for production process and upstream and downstream operations from production plan or request. 1.2 Identify materials required, including additives. 1.3 Recognise hazards and follow appropriate hazard control/minimisation methods. 1.4 Identify and check emergency stops, guards and controls.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	1.5 Identify requirements for materials, quality, production and equipment checks. 1.6 Identify materials, waste management and housekeeping needs.
2. Start up pre-preg process.	2.1 Determine equipment requirements. 2.2 Adjust control panel (eg cycle time, heating, cooling) as required for factors such as temperature, material etc. 2.3 Check equipment, raw material and die/tool all match job requirements. 2.4 Check materials, pre-pregs, release agents etc, are correct. 2.5 Discard, or make adjustments to the process for, non-conforming materials. 2.6 Set up date, batch and materials markings to specifications, as required. 2.7 Complete other pre-start checks in accordance with procedures. 2.8 Start up pre-preg process
3. Operate and make adjustments as required to the process.	3.1 Operate composites forming equipment, noting key variables. 3.2 Monitor controls/displays/terminals for production/process data. 3.3 Monitor product/process quality, thickness and integrity to procedures. 3.4 Make adjustments to remedy faults and nonconformity to standard as required. 3.5 Maintain continuity of process. 3.6 Collect and reprocess/discard scrap/waste and other materials in accordance with procedures. 3.7 Clean, adjust and lubricate equipment as required. 3.8 Pause or stop equipment in an emergency, following procedures.
4. Shut down machine to procedures	4.1 Determine type of shut down 4.2 Select appropriate cleaning method 4.3 Clean efficiently and adequately as required

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices 4.5 Complete relevant documentation 4.6 Ensure area is clean and clear after the shutdown, in readiness for the next start-up
5. Anticipate and solve problems	5.1 Recognise a problem or a potential problem. 5.2 Determine problems needing priority action. 5.3 Refer problems outside area of responsibility to appropriate person, with possible causes. 5.4 Seek information and assistance as required to solve problems. 5.5 Solve problems within area of responsibility. 5.6 Follow through items initiated until final resolution has occurred.

## Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit.

Application of knowledge of the materials, equipment and process sufficient to recognise material and equipment conditions which may lead to out of specification production.

Knowledge of organization procedures and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.

Application of the knowledge of managing risks using the hierarchy of controls applied to the pre-preg moulding process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Knowledge as a basis for solving processing and material problems including:

- products, materials and material characteristics
- behaviour of materials in relation to heat, pressure and time
- quality requirements at each production stage
- function and operating principles of composites forming equipment, machine components and ancillary equipment
- impact of temperature, pressure, time during cycles on product quality and production output

- nature of mechanical, hydraulic, pneumatic, electrical and electronic principles which effect machine operation and product development
- safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup
- the hierarchy of control, including engineering controls
- impact of variations in raw materials and equipment operation in relation to final product
- changes to materials at various stages of production
- waste management and importance of non-conforming materials
- make adjustments to equipment operation to rectify variations in equipment operation or product quality
- check composites forming equipment for correct set-up to job specifications and implement adjustments or report deviations immediately
- make measurements when required and identify product out of specification
- distinguish between causes of faults
- polymer properties and their interactions with process conditions
- relationships between polymer properties and process conditions
- changes to polymer properties to better suit process requirements
- product problems related to polymer properties
- product problems related to process conditions
- adjustments to process conditions to meet polymer and product requirements.

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- interpret from production requests the correct selection and use of equipment, materials, processes and procedures
- maintain output and product quality using appropriate instruments, controls, test information and readings
- identify and describe own role and role of others involved directly in the process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when the operator is able to rectify faults and when assistance is required.

### **Language, literacy and numeracy requirements**

This unit requires the ability to read and interpret typical product specifications, job sheets and material labels as provided to operators.

Writing is required to the level of completing workplace forms and production reports.

Numeracy is required to the level of determining required weights/volumes of materials in a resin mix for different circumstances (say using a data sheet), number of layers of impregnated matrix required to yield the required product laminate thickness, and similar activities.

## Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

### Overview of assessment

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Where the assessee does not currently possess evidence of competency in *PMBPROD298A Operate equipment using pre-pregs* material, it may be co-assessed with this unit.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify critical materials properties and composites moulding process characteristics in relation to the process requirements and the end product
- plan own work process within workplace procedures and explain the reasons for the steps in the process
- take appropriate action to observe equipment, materials and products for out of specification results, make adjustments and identify problems to be reported.

Consistent performance should be demonstrated. For example, look to see that:

- production quality and output standards are met consistently
- problems are anticipated from process observations
- problems are efficiently resolved
- the process runs consistently and smoothly.

### Assessment method and context

Assessment will occur on an industrial pre-pregs and equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- using an appropriate, industrial pre-preg and equipment
- in a situation allowing for the generation of evidence of the ability to recognise, anticipate and respond to problems
  - by using a suitable simulation and/or a range of case studies/scenarios
  - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

### **Specific resources for assessment**

This section should be read in conjunction with the range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

## **Range Statement**

### **RANGE STATEMENT**

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts.

Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

### **Context**

This competency applies to manufacture of composites products using pre-pregs within the plastics and rubber industries.

It includes all moulds, pumps and programmable logic controllers (PLCs) if fitted and all relevant ancillary equipment integral to the composites forming process.

### **Procedures**

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

### **Tools and equipment**

This competency includes use of equipment and tools such as:

- moulds, formers, closures and fittings
- equipment including presses and ancillaries
- controller, such as PLC if fitted

- relevant personal protective equipment (PPE)
- hand tools used in the production process
- material loading equipment used for loading of raw materials
- release films and fabrics
- pre-pregs.

### **Hazards**

Typical hazards include:

- hazardous vapours and materials
- fibres, airborne and handled
- humidity, air temperatures, radiant heat, hot moulds
- stationary and moving machinery, parts and components
- manual handling hazards.

### **Problems**

Respond to/rectify 'non-routine problems' means 'apply known solutions to a variety of predictable problems'.

Typical process and product problems may include:

- pre-preg incorrectly applied to mould
- release agents performance
- contamination
- temperature variations, affecting resin cure-rate
- blemishes
- missing detail
- warped moulds or dies
- worn or damaged mould parts or fittings
- variations in materials and/or contamination of materials
- processing
- heat
- poor handling or storage of pre-pregs
- equipment - adjustments/set-up
- equipment - maintenance requirements incorrect quantity of materials
- contaminated materials.

### **Variables**

Key variables to be monitored include:

- operating temperatures
- cycle time
- output rate
- surface finish and condition
- product weight
- product integrity and general conformance to specification/sample.
-

## **Unit Sector(s)**

Not applicable.



## **PRSTS202A Install security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to install a range of types of security equipment and systems. It requires the ability to select and use materials, tools and equipment appropriate to job requirements, effectively install security equipment/systems for the intended purpose, and complete documentation in an accurate and timely manner.

This work applies in extra low voltage as defined through the Australian Standards AS 2201 (1986) environments. These work functions would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to install a range of types of security equipment and systems. It requires the ability to select and use materials, tools and equipment appropriate to job requirements, effectively install security equipment/systems for the intended purpose, and complete documentation in an accurate and timely manner.

This work applies in extra low voltage as defined through the Australian Standards AS 2201 (1986) environments. These work functions would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for installation	<ul style="list-style-type: none"><li>1.1 Work order and client requirements are reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements</li><li>1.2 Security equipment / system to be installed is identified and checked against work order in accordance with organisational procedures</li><li>1.3 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications and organisational procedures</li><li>1.4 Suitable personal protective equipment is selected and maintained in accordance with OHS and organisational requirements</li><li>1.5 Potential and existing risks and hazards in the work area are identified and controlled in accordance with OHS, legislative and organisational requirements</li></ul>
2 Install security equipment / system	<ul style="list-style-type: none"><li>2.1 All work is conducted using safe operating practices in accordance with OHS, legislative and organisational requirements</li><li>2.2 Security equipment / system is installed in specified positions and locations to maximise security coverage in accordance with manufacturer's specifications and client requirements</li><li>2.3 Security equipment / system is fixed securely and is terminated and connected to cable as required in accordance with manufacturer's specifications and relevant industry standards</li></ul>

- 2.4 Security equipment / systems are installed without damage or distortion to the surrounding environment or services and in a manner that maximises safety of self and others
  - 2.5 Factors affecting the achievement of assignment instructions are promptly identified and recommendations for variation to installation plans are negotiated with and approved by appropriate person(s)
- 3 Complete installation
  - 3.1 Final inspections are undertaken to ensure operational effectiveness of installed security equipment / system in accordance with industry, legislative and work order requirements
  - 3.2 Notification of work completion is made to appropriate person(s) in accordance with organisational procedures
  - 3.3 Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements
  - 3.4 Malfunctions, faults, wear or damage to tools is accurately documented and reported for repair or replacement in accordance with organisational policies and procedures
  - 3.5 Relevant documentation is completed in an accurate and timely manner in accordance with industry, legislative and organisational requirements

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to install security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Select correct tools and equipment and apply appropriate methods and safe operating practices to install, locate and position security equipment/system to satisfy client job and organisational requirements.

Methodically organise own work tasks, safely and efficiently follow installation procedures and carry out checks to ensure integrity, security and safety of security equipment/systems.

Clean and safely store tools and equipment and reinstate work sites in a clear and tidy condition.

Interpret and comply with all applicable statutory and legislative guidelines and accurately complete all relevant documentation.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

building construction methods and types

technical terminology

types, functions and requirements of security equipment/systems

types, functions and uses of end-of-line devices and resistors

methods of equipment/system installation

installation hazards

methods of fixing equipment/systems

cable termination and connection

methods of sealing cable entries

electrical concepts, electrical connections

cable identification and handling requirements

earthing systems arrangements and requirements

confined space procedures

organisational and client confidentiality requirements

OHS requirements and safe work practices

requirements for compliance with Australian building codes and regulations and Australian Communications Authority cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

communicate in a clear and concise manner

read and interpret plans and specifications

use suitable tools and equipment, including hand and power tools

fit end-of-line devices

install and fix security equipment/systems

terminate and connect cable

identify cable

hand cable

solder, drill

carry out basic carpentry

conduct 'fix and make good' practices

methodically organise and prioritise work tasks

solve routine problems

work in confined spaces

apply safe and environmentally aware work practices.

### **What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(1)**

Appropriate notification is made to relevant persons upon completion of installation work.

How can **information be collected, analysed and organised**? **(1)**

Client requirements and work order instructions may be reviewed to estimate and arrange materials, tools and equipment suitable to carry out installation of security equipment/systems.

How are **activities planned and organised**? **(1)**

Ongoing checks of the quality of the installation work are undertaken to ensure the installed security equipment/system conforms to work order and client requirements.

How can **team work** be applied? **(1)**

Additional information and advice may be sought from relevant persons to ensure the most efficient and effective procedures may be applied in the installation of security equipment/systems.

How can the use of **mathematical ideas and techniques** be applied? **(1)**

Mathematical techniques may be used to plan and schedule work tasks and arrange adequate tool and equipment provisioning.

How can **problem solving skills** be applied? **(1)**

Variations to installation plans may be negotiated and implemented in situations where unplanned events or conditions occur.

How can the **use of technology** be applied? **(1)**

Technology may be used to communicate, schedule and document information. It may also be used to carry out installation testing.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to install security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Select correct tools and equipment and apply appropriate methods and safe operating practices to install, locate and position security equipment/system to satisfy client job and organisational requirements.

Methodically organise own work tasks, safely and efficiently follow installation procedures and carry out checks to ensure integrity, security and safety of security equipment/systems.

Clean and safely store tools and equipment and reinstate work sites in a clear and tidy condition.

Interpret and comply with all applicable statutory and legislative guidelines and accurately complete all relevant documentation.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

building construction methods and types

technical terminology

types, functions and requirements of security equipment/systems

types, functions and uses of end-of-line devices and resistors

methods of equipment/system installation

installation hazards

methods of fixing equipment/systems

cable termination and connection

methods of sealing cable entries

electrical concepts, electrical connections

cable identification and handling requirements

earthing systems arrangements and requirements

confined space procedures

organisational and client confidentiality requirements

OHS requirements and safe work practices

requirements for compliance with Australian building codes and regulations and Australian Communications Authority cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

communicate in a clear and concise manner

read and interpret plans and specifications

use suitable tools and equipment, including hand and power tools

fit end-of-line devices

install and fix security equipment/systems

terminate and connect cable

identify cable

hand cable

solder, drill

carry out basic carpentry

conduct 'fix and make good' practices

methodically organise and prioritise work tasks

solve routine problems

work in confined spaces

apply safe and environmentally aware work practices.

### **What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

#### **1 - perform the process**



**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (1)

Appropriate notification is made to relevant persons upon completion of installation work.

How can **information be collected, analysed and organised**? (1)

Client requirements and work order instructions may be reviewed to estimate and arrange materials, tools and equipment suitable to carry out installation of security equipment/systems.

How are **activities planned and organised**? (1)

Ongoing checks of the quality of the installation work are undertaken to ensure the installed security equipment/system conforms to work order and client requirements.

How can **team work** be applied? (1)

Additional information and advice may be sought from relevant persons to ensure the most efficient and effective procedures may be applied in the installation of security equipment/systems.

How can the use of **mathematical ideas and techniques** be applied? (1)

Mathematical techniques may be used to plan and schedule work tasks and arrange adequate tool and equipment provisioning.

How can **problem solving skills** be applied? (1)

Variations to installation plans may be negotiated and implemented in situations where unplanned events or conditions occur.

How can the **use of technology** be applied? (1)

Technology may be used to communicate, schedule and document information. It may also be used to carry out installation testing.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may include:**

work schedules

completion dates

job requirements and tasks

specific client requirements

access to site and specific site requirements

resource requirements

OHS requirements

legislative requirements

budget allocations

warranties and service information.

**Client requirements may relate to:**

requirements as detailed in security assessment or client brief

system capabilities and functions

equipment and/or system type

equipment locations and positions

installation procedures and schedule

service and maintenance requirements

monitoring requirements

warranties/guarantees.

**Appropriate persons may include:**

clients

site managers, project managers

engineers and technicians

technical experts

line managers/supervisors

colleagues

regulatory personnel

security consultants.

**Organisational requirements may relate to:**

legal and organisational policies and procedures including personnel practices and guidelines

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

policies and procedures relating to own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

Occupational Health and Safety policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices  
cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
electronic locks and locking systems  
low voltage lighting, boom gates, turnstiles  
bank pop-up screens  
biometrics  
electric/mechanical fire safety and fire locking systems  
low voltage power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Tools and equipment may include:**

multimeter, F-set, cable testing equipment  
hand tools, power tools, fixing tools, crimp tools, IDS tools  
flexible rods, fishing tools  
strippers, router, file, followers, spirit level  
soldering iron  
ladder, scaffold, scissor lift, hoist, drop sheet, batteries  
personal protective equipment  
communications equipment.

**Materials may include:**

fixings:  
saddles, conduit, loxins, girderclips, wall plugs, hollow wall anchors, silicon, screws, parts  
and components  
  
wire and cable  
solder, insulation tape

glue, paint, patch materials, sealing compounds  
electronic components.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
safety boots, knee pads  
gloves  
warning hats, flashing lights  
warning signs and tapes  
fire extinguisher  
first aid kit.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms  
implementation of safety regulations  
safety training  
safety systems incorporating:  
work clearance procedures  
isolation procedures  
gas and vapour  
monitoring/testing procedures  
use of protective equipment and clothing

use of codes of practice.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
exposed electrical wiring  
manual handling  
chemical hazards (battery corrosion)  
exposure to:  
asbestos, dust, noise, live power, vermin, water, glass fibre, building debris, natural and other  
gas build-up.

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues

equal employment opportunity  
industrial relations  
anti-discrimination and diversity

Australian building codes and regulations  
Australian Communications Authority cabling standards  
licensing requirements  
Australian Standards, quality assurance and certification requirements  
relevant industry Codes of Practice  
trade practices, award and enterprise agreements  
privacy requirements.

**Safe operating practices may relate to:**

working with electrical wiring, cables and overhead power lines  
working with tools and equipment  
risk and hazard recognition  
emergency procedures  
following confined spaces procedures.

**Environment may include:**

atmosphere  
soils  
drains  
underground water tables  
the ecosystem.

**Factors may include:**

competing work demands  
technology/equipment breakdowns  
workplace hazards, risks and controls  
environmental factors (time, weather)  
non-availability of resource and materials  
budget constraints.

**Documentation may include:**

records of security equipment/system positioning  
section lists, zone lists, equipment lists  
cable identification records, fixings, job card

records of any adjustments to original cable plan  
records of faulty or malfunctioning tools and equipment  
testing and inspection results  
records of materials used.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may include:**

work schedules  
completion dates  
job requirements and tasks  
specific client requirements  
access to site and specific site requirements  
resource requirements  
OHS requirements  
legislative requirements  
budget allocations  
warranties and service information.

**Client requirements may relate to:**

requirements as detailed in security assessment or client brief  
system capabilities and functions  
equipment and/or system type  
equipment locations and positions  
installation procedures and schedule  
service and maintenance requirements  
monitoring requirements  
warranties/guarantees.

**Appropriate persons may include:**

clients  
site managers, project managers  
engineers and technicians  
technical experts  
line managers/supervisors  
colleagues

regulatory personnel

security consultants.

**Organisational requirements may relate to:**

legal and organisational policies and procedures including personnel practices and guidelines

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

policies and procedures relating to own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

Occupational Health and Safety policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

electronic locks and locking systems

low voltage lighting, boom gates, turnstiles

bank pop-up screens

biometrics

electric/mechanical fire safety and fire locking systems

low voltage power supplies, batteries

security doors and door controls.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Tools and equipment may include:**

multimeter, F-set, cable testing equipment

hand tools, power tools, fixing tools, crimp tools, IDS tools

flexible rods, fishing tools

strippers, router, file, followers, spirit level

soldering iron

ladder, scaffold, scissor lift, hoist, drop sheet, batteries

personal protective equipment

communications equipment.

**Materials may include:**

fixings:

saddles, conduit, loxins, girderclips, wall plugs, hollow wall anchors, silicon, screws, parts and components

wire and cable

solder, insulation tape

glue, paint, patch materials, sealing compounds

electronic components.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs

safety boots, knee pads

gloves

witches hats, flashing lights

warning signs and tapes

fire extinguisher

first aid kit.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms

implementation of safety regulations

safety training

safety systems incorporating:

work clearance procedures

isolation procedures

gas and vapour

monitoring/testing procedures

use of protective equipment and clothing



use of codes of practice.

**Risks and hazards may include:**

non-compliance with building codes and regulations

exposed electrical wiring

manual handling

chemical hazards (battery corrosion)

exposure to:

asbestos, dust, noise, live power, vermin, water, glass fibre, building debris, natural and other gas build-up.

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety and safe work practices

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity

Australian building codes and regulations

Australian Communications Authority cabling standards

licensing requirements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements.

**Safe operating practices may relate to:**

working with electrical wiring, cables and overhead power lines

working with tools and equipment

risk and hazard recognition

emergency procedures

following confined spaces procedures.

**Environment may include:**

atmosphere

soils

drains

underground water tables

the ecosystem.

**Factors may include:**

competing work demands

technology/equipment breakdowns

workplace hazards, risks and controls

environmental factors (time, weather)

non-availability of resource and materials

budget constraints.

**Documentation may include:**

records of security equipment/system positioning

section lists, zone lists, equipment lists

cable identification records, fixings, job card

records of any adjustments to original cable plan

records of faulty or malfunctioning tools and equipment

testing and inspection results

records of materials used.

**Unit Sector(s)**

Not applicable.

## **PRSTS302A Program security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to program and configure a range of security equipment/systems. It requires the ability to clearly identify programming requirements and configuration parameters for the type of security equipment or system, use safe and efficient work practices, maintain a hazard-free work area, and maintain accurate records and information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to program and configure a range of security equipment/systems. It requires the ability to clearly identify programming requirements and configuration parameters for the type of security equipment or system, use safe and efficient work practices, maintain a hazard-free work area, and maintain accurate records and information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for programming	<ul style="list-style-type: none"><li>1.1 Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements</li><li>1.2 Security equipment / system programming requirements and configuration parameters are identified and accurately understood</li><li>1.3 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications and organisational procedures</li><li>1.4 Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements</li><li>1.5 Potential and existing risks and hazards to programming are identified and managed in accordance with OHS and organisational requirements</li></ul>
2 Program security equipment / system	<ul style="list-style-type: none"><li>2.1 All work is conducted using safe operating practices in accordance with legislative, OHS and organisational requirements</li><li>2.2 Security equipment / system is powered, programmed and configured in accordance with work order, manufacturer's specifications and relevant industry standards</li><li>2.3 Correct security equipment / system operational procedures and compliance requirements are observed and followed in accordance with manufacturer's specifications and organisational requirements</li></ul>

- |                                   |   |
|-----------------------------------|---|
|                                   | 2.4 Security equipment / system configuration is checked to confirm required operation and functioning in accordance with organisational requirements           |
|                                   | 2.5 Alterations or changes to programming requirements are confirmed with appropriate person(s) in accordance with organisational procedures                    |
| 3 Complete programming activities | 3.1 Final inspections are undertaken to ensure security equipment / system programming conforms to work order and client requirements                           |
|                                   | 3.2 Notification of work completion is made to appropriate person(s) in accordance with organisational procedures   |
|                                   | 3.3 Documentation is completed promptly and accurately and processed in accordance with client and organisational requirements                                  |
|                                   | 3.4 Work area, tools and equipment are cleaned and stored in secure and safe locations in accordance with organisational requirements                           |
|                                   | 3.5 Waste from programming activities is collected, treated and disposed of or recycled in accordance with organisational procedures and environmental policies |

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to program a range of security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### What critical aspects are required for evidence of competency?

Clearly identify programming requirements and configuration parameters of security equipment/systems and organise appropriate tools, equipment and materials to carry out work.

Follow safe and efficient work practices in the use of tools and equipment and accurately identify and manage risks and hazards to programming work and work areas.

Access security equipment/systems and methodically carry out programming and configuration procedures with minimal disruption to client, services or normal work routines.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and prepare and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

building construction methods and types

powering systems types, functions and requirements of security equipment/systems

keypad and control panel types and functions

methods of equipment/system programming

security equipment/system configurations

computer software types and functions

electrical concepts (voltage, current, resistance, impedance)

cable identification and handling requirements

earthing systems arrangements and requirements

technical terminology

organisational and client confidentiality requirements

OHS requirements and safe work practices.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

communicate in a clear and concise manner

read and interpret plans and specifications

select and use suitable tools and equipment

power systems

program and configure security equipment/systems

methodically prioritise and organise work tasks

operate security equipment/systems

download/upload information

test security equipment systems and read a multimeter

accurately identify and handle cables

solve routine problems

estimate resource requirements

apply safe and efficient work practices.

### **What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(2)**

Programming requirements and configuration parameters may be clarified and confirmed with relevant persons to ensure client needs are accurately met.

How can **information be collected, analysed and organised?** **(2)**

Conducted inspections and checks of programming and configuration work may be accurately documented and organised by records or reports.

How are **activities planned and organised**? (2)

Notification may be made to relevant persons upon completion of programming and configuration work.

How can **team work** be applied? (2)

Requirements for alterations or changes to programming or configuration of security equipment/systems may be discussed with relevant persons.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Potential and existing risks and hazards associated with programming work are promptly identified and controlled.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to program a range of security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Clearly identify programming requirements and configuration parameters of security equipment/systems and organise appropriate tools, equipment and materials to carry out work.

Follow safe and efficient work practices in the use of tools and equipment and accurately identify and manage risks and hazards to programming work and work areas.

Access security equipment/systems and methodically carry out programming and configuration procedures with minimal disruption to client, services or normal work routines.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and prepare and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

building construction methods and types

powering systems types, functions and requirements of security equipment/systems

keypad and control panel types and functions

methods of equipment/system programming



security equipment/system configurations  
computer software types and functions  
electrical concepts (voltage, current, resistance, impedance)  
cable identification and handling requirements  
earthing systems arrangements and requirements  
technical terminology  
organisational and client confidentiality requirements  
OHS requirements and safe work practices.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

communicate in a clear and concise manner  
read and interpret plans and specifications  
select and use suitable tools and equipment  
power systems  
program and configure security equipment/systems  
methodically prioritise and organise work tasks  
operate security equipment/systems  
download/upload information  
test security equipment systems and read a multimeter  
accurately identify and handle cables  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(2)**

Programming requirements and configuration parameters may be clarified and confirmed with relevant persons to ensure client needs are accurately met.

How can **information be collected, analysed and organised**? **(2)**

Conducted inspections and checks of programming and configuration work may be accurately documented and organised by records or reports.

How are **activities planned and organised**? **(2)**

Notification may be made to relevant persons upon completion of programming and configuration work.

How can **team work** be applied? **(2)**

Requirements for alterations or changes to programming or configuration of security equipment/systems may be discussed with relevant persons.

How can the use of **mathematical ideas and techniques** be applied? **(2)**

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? **(2)**

Potential and existing risks and hazards associated with programming work are promptly identified and controlled.

How can the **use of technology** be applied? **(2)**

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### **Work order information may relate to:**

work schedules  
completion dates  
job requirements and tasks  
specific client requirements  
access to site and specific site requirements  
resource requirements  
OHS requirements  
compliance with relevant legislation  
budget allocations  
warranties and service information.

### **Appropriate person(s) may include:**

clients  
site managers, project managers  
engineers and technicians  
technical experts  
line managers/supervisors  
colleagues, security consultants  
regulatory personnel.

### **Organisational requirements may relate to:**

legal and organisational operational policies and procedures  
operations manuals, induction and training materials  
insurance policy agreements  
client and organisational confidentiality requirements  
organisational goals, objectives, plans, systems and processes  
employer and employee rights and responsibilities  
own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

OHS policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

smoke detection devices

electric/mechanical fire safety and fire locking systems

power supplies, batteries.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Programming requirements and configuration parameters:**

may be found in:

work order

system plans and specifications

manufactures specifications

may include:

alarm types

reporting

access controls

alerting monitoring station.

**Tools and equipment may include:**

multimeter, F-set, cable testing equipment

hand tools, power tools, fixing tools, crimp tools, IDS tools

flexible rods, fishing tools

strippers, router, file, followers, spirit level

soldering iron, welder

lockpick, pick gun

ladder, scaffold, scissor lift, hoist, drop sheet, batteries

personal protective equipment

communications equipment.

**Materials may include:**

computer disks.

**Personal protective equipment may include:**

safety boots

masks

safety glasses

knee pads

gloves

first aid kit, fire extinguisher.

**Risks and hazards may include:**

non-compliance with building codes and regulations

exposed electrical wiring

manual handling

chemical hazards (battery corrosion)

exposure to:

asbestos

dust

noise

live power

vermin

water

glass fibre

building debris

natural and other gas build-up.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations

compliance with Australian Communications Authority (ACA) cabling standards

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety and safe work practices

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity.

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements and privacy related legislation.

**Documentation may include:**

completion of work log

security equipment/system positioning

cable identification

adjustments to original cable plan

section lists, zone lists, equipment lists

fixings, job card.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may relate to:**

- work schedules
- completion dates
- job requirements and tasks
- specific client requirements
- access to site and specific site requirements
- resource requirements
- OHS requirements
- compliance with relevant legislation
- budget allocations
- warranties and service information.

**Appropriate person(s) may include:**

- clients
- site managers, project managers
- engineers and technicians
- technical experts
- line managers/supervisors
- colleagues, security consultants
- regulatory personnel.

**Organisational requirements may relate to:**

- legal and organisational operational policies and procedures
- operations manuals, induction and training materials
- insurance policy agreements
- client and organisational confidentiality requirements
- organisational goals, objectives, plans, systems and processes
- employer and employee rights and responsibilities
- own role, responsibility and delegation
- quality and continuous improvement processes and standards
- client service standards
- defined resource parameters
- OHS policies, procedures and programs

emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices  
cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Programming requirements and configuration parameters:**

may be found in:

work order  
system plans and specifications  
manufactures specifications

may include:

alarm types  
reporting  
access controls  
alerting monitoring station.

**Tools and equipment may include:**



multimeter, F-set, cable testing equipment  
 hand tools, power tools, fixing tools, crimp tools, IDS tools  
 flexible rods, fishing tools  
 strippers, router, file, followers, spirit level  
 soldering iron, welder  
 lockpick, pick gun  
 ladder, scaffold, scissor lift, hoist, drop sheet, batteries  
 personal protective equipment  
 communications equipment.

**Materials may include:**

computer disks.

**Personal protective equipment may include:**

safety boots  
 masks  
 safety glasses  
 knee pads  
 gloves  
 first aid kit, fire extinguisher.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
 exposed electrical wiring  
 manual handling  
 chemical hazards (battery corrosion)  
 exposure to:  
 asbestos  
 dust  
 noise  
 live power  
 vermin  
 water  
 glass fibre  
 building debris  
 natural and other gas build-up.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations

compliance with Australian Communications Authority (ACA) cabling standards

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety and safe work practices

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity.

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements and privacy related legislation.

**Documentation may include:**

completion of work log

security equipment/system positioning

cable identification

adjustments to original cable plan

section lists, zone lists, equipment lists

fixings, job card.

**Unit Sector(s)**

Not applicable.

## **PRSTS303A Test installed security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to test a range of security equipment and systems including cable systems, equipment components and programming. It requires the ability to select and carry out tests suitable to confirm the integrity, security and safety of the security equipment/system. Competency also requires the ability to interpret and accurately document the test results. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to test a range of security equipment and systems including cable systems, equipment components and programming. It requires the ability to select and carry out tests suitable to confirm the integrity, security and safety of the security equipment/system. Competency also requires the ability to interpret and accurately document the test results. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for testing	<ul style="list-style-type: none"><li>1.1 Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements</li><li>1.2 Type and location of security equipment / system to be tested is identified and checked against the work order</li><li>1.3 Testing parameters are identified and confirmed in accordance with manufacturer's specifications</li><li>1.4 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications and organisational procedures</li><li>1.5 Potential and existing risks and hazards involved with testing security equipment / systems are identified and managed in accordance with OHS policies and procedures and organisational requirements</li><li>1.6 Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements</li></ul>
2 Test security equipment / system	<ul style="list-style-type: none"><li>2.1 Safe operating practices are observed to remove risk of injury to self, others or security equipment / system in accordance with OHS and organisational requirements</li><li>2.2 Parts or connections of security equipment / system are removed as required in accordance with manufacturer's specifications and safely stored to protect against loss or damage</li><li>2.3 Tests are conducted in accordance with manufacturer's specifications and provide reliable</li></ul>

and accurate test data on the operation and functioning of security equipment / systems

- 2.4 Security equipment / system is reassembled as required and returned to pre-test conditions in accordance with manufacturer's specifications
  - 2.5 Personal limitations in conducting testing are promptly identified and assistance is sought from appropriate person(s) in accordance with organisational procedures
- 3 Complete testing
- 3.1 Tests results are accurately recorded and relevant documentation is completed and processed in accordance with legislative, industry and organisational requirements
  - 3.2 Notification of work completion is made to appropriate person(s) in accordance with organisational procedures
  - 3.3 Malfunctions or deficiencies in the operation of security equipment / system and / or components are reported in accordance with industry standards and organisational procedures
  - 3.4 Work area, tools and equipment are cleaned and stored in a secure and safe location in accordance with organisational requirements
  - 3.5 Waste from testing activities is collected, treated and disposed of or recycled in accordance with organisational procedures and environmental policies

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to test installed security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Identify testing parameters appropriate to type of security equipment/system and organise appropriate tools, equipment and materials to carry out testing procedures.

Select and carry out suitable tests and methods to check and confirm security equipment/system performance and operational effectiveness.

Prepare and submit correctly interpreted test results and other relevant documentation in a prompt and accurate manner.

Reinstate work area to pre-test condition and clean and safely store tools and equipment.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

powering systems types, functions and requirements of security equipment/systems

keypad and control panel types and functions

types and functions of tools and equipment

isolating and testing procedures

cable identification techniques

earthing systems, arrangements and requirements

electrical concepts (voltage, current, resistance and impedance)

electrical connections and types of electrical circuits

circuit protection requirements

cable handling requirements

computer software types and functions

technical terminology

organisational and client confidentiality requirements

OHS requirements and safe work practices

Requirements for compliance with Australian building codes and regulations and Australian Communications Authority (ACA) cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret plans and specifications

communicate in a clear and concise manner

select and use relevant testing tools and equipment

test security equipment/systems

evaluate test results

identify, isolate, test and tag cables  
power security equipment/system  
download and upload information  
use keypads and control panels  
methodically prioritise and organise work tasks  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

Notification may be made to relevant persons upon the completion of testing procedures of security equipment/systems.

How can **information be collected, analysed and organised**? (2)

Tests results may be interpreted, accurately recorded and organised in suitable formats for analysis.

How are **activities planned and organised**? (2)

Security equipment/systems for testing may be accessed with minimal disruption to client services, property or normal work routines.

How can **team work** be applied? (2)

Personal limitations in carrying out testing procedures may be promptly identified and assistance sought from relevant persons.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Malfunctions or deficiencies in the operation of security equipment/system and/or components are promptly reported for remedial action.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to test installed security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Identify testing parameters appropriate to type of security equipment/system and organise appropriate tools, equipment and materials to carry out testing procedures.

Select and carry out suitable tests and methods to check and confirm security equipment/system performance and operational effectiveness.

Prepare and submit correctly interpreted test results and other relevant documentation in a prompt and accurate manner.

Reinstate work area to pre-test condition and clean and safely store tools and equipment.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:



powering systems types, functions and requirements of security equipment/systems  
keypad and control panel types and functions  
types and functions of tools and equipment  
isolating and testing procedures  
cable identification techniques  
earthing systems, arrangements and requirements  
electrical concepts (voltage, current, resistance and impedance)  
electrical connections and types of electrical circuits  
circuit protection requirements  
cable handling requirements  
computer software types and functions  
technical terminology  
organisational and client confidentiality requirements  
OHS requirements and safe work practices  
Requirements for compliance with Australian building codes and regulations and Australian Communications Authority (ACA) cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret plans and specifications  
communicate in a clear and concise manner  
select and use relevant testing tools and equipment  
test security equipment/systems  
evaluate test results  
identify, isolate, test and tag cables  
power security equipment/system  
download and upload information  
use keypads and control panels  
methodically prioritise and organise work tasks  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(2)**

Notification may be made to relevant persons upon the completion of testing procedures of security equipment/systems.

How can **information be collected, analysed and organised**? **(2)**

Tests results may be interpreted, accurately recorded and organised in suitable formats for analysis.

How are **activities planned and organised**? **(2)**

Security equipment/systems for testing may be accessed with minimal disruption to client services, property or normal work routines.

How can **team work** be applied? **(2)**

Personal limitations in carrying out testing procedures may be promptly identified and assistance sought from relevant persons.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Malfunctions or deficiencies in the operation of security equipment/system and/or components are promptly reported for remedial action.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### **Work order information may include:**

- work schedules
- completion dates
- job requirements and tasks
- specific client requirements
- access to site and specific site requirements
- resource requirements
- OHS requirements
- compliance with relevant legislation
- budget allocations
- warranties and service information.

### **Appropriate person(s) may include:**

- clients
- site managers, project managers
- engineers and technicians
- technical experts
- line managers/supervisors
- colleagues, security consultants
- regulatory personnel.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures  
operations manuals, induction and training materials  
insurance policy agreements  
client and organisational confidentiality requirements  
organisational goals, objectives, plans, systems and processes  
employer and employee rights and responsibilities  
own role, responsibility and delegation  
quality and continuous improvement processes and standards  
client service standards  
defined resource parameters  
OHS policies, procedures and programs  
emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices  
cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised

procedural.

**Tests may involve/include :**

cables

wiring and connections (continuity, resistance, earth leakage, voltage)

walk tests, coverage tests, safety tests, calibration tests

correct relaying of information/data

testing to specifications

detection tests, alarm tests, functional tests.

**Tools and equipment may include:**

computer, software

testing equipment

ladder, scaffold, scissor lift, hoist

batteries

personal protective equipment

communications equipment.

**Materials may include:**

computer disks

test board

test tape.

**Manufacturers specifications may be found in:**

printed instruction leaflets

operators manuals

equipment specifications

attachments to equipment

plans and diagrams

warranty documents.

**Risks and hazards may include:**

non-compliance with building codes and regulations

exposed electrical wiring

manual handling

chemical hazards (battery corrosion)

exposure to:

asbestos

dust

noise

live power

vermin

water

glass fibre

building debris

natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms

implementation of safety regulations

safety training

safety systems incorporating:

work clearance procedures

isolation procedures

gas and vapour

monitoring/testing procedures

use of protective equipment and clothing

use of codes of practice.

**Personal protective equipment may include:**

safety boots

masks

safety glasses

knee pads

gloves

first aid kit, fire extinguisher.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid.

**Documentation may include:**

work log  
records of equipment/system positioning  
section lists, zone lists, equipment lists  
cable identification records, fixings, job card  
records of any adjustments to original cable plan  
records of faulty or malfunctioning tools and equipment  
testing and inspection results  
records of materials used  
costings.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

award and enterprise agreements

trade practices

privacy requirements

freedom of information.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may include:**

work schedules  
completion dates  
job requirements and tasks

specific client requirements  
access to site and specific site requirements  
resource requirements  
OHS requirements  
compliance with relevant legislation  
budget allocations  
warranties and service information.

**Appropriate person(s) may include:**

clients  
site managers, project managers  
engineers and technicians  
technical experts  
line managers/supervisors  
colleagues, security consultants  
regulatory personnel.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures  
operations manuals, induction and training materials  
insurance policy agreements  
client and organisational confidentiality requirements  
organisational goals, objectives, plans, systems and processes  
employer and employee rights and responsibilities  
own role, responsibility and delegation  
quality and continuous improvement processes and standards  
client service standards  
defined resource parameters  
OHS policies, procedures and programs  
emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices



cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Tests may involve/include :**

cables  
wiring and connections (continuity, resistance, earth leakage, voltage)  
walk tests, coverage tests, safety tests, calibration tests  
correct relaying of information/data  
testing to specifications  
detection tests, alarm tests, functional tests.

**Tools and equipment may include:**

computer, software  
testing equipment  
ladder, scaffold, scissor lift, hoist  
batteries  
personal protective equipment  
communications equipment.

**Materials may include:**

computer disks  
test board  
test tape.

**Manufacturers specifications may be found in:**

printed instruction leaflets  
operators manuals  
equipment specifications  
attachments to equipment  
plans and diagrams  
warranty documents.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
exposed electrical wiring  
manual handling  
chemical hazards (battery corrosion)  
exposure to:  
asbestos  
dust  
noise  
live power  
vermin  
water  
glass fibre  
building debris  
natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms  
implementation of safety regulations  
safety training  
safety systems incorporating:  
work clearance procedures  
isolation procedures  
gas and vapour  
monitoring/testing procedures  
use of protective equipment and clothing  
  
use of codes of practice.

**Personal protective equipment may include:**

safety boots  
masks  
safety glasses  
knee pads  
gloves  
first aid kit, fire extinguisher.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines  
working safely around tools and equipment  
hazard recognition  
emergency procedures  
awareness of electrical hazards  
following confined spaces procedures  
administering first aid.

**Documentation may include:**

work log  
records of equipment/system positioning  
section lists, zone lists, equipment lists  
cable identification records, fixings, job card  
records of any adjustments to original cable plan  
records of faulty or malfunctioning tools and equipment  
testing and inspection results  
records of materials used  
costings.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

award and enterprise agreements

trade practices

privacy requirements

freedom of information.

## **Unit Sector(s)**

Not applicable.

## **PRSTS304A Commission/decommission security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to commission and decommission a range of security equipment and systems. It requires the ability to clearly identify and follow correct commissioning/decommissioning procedures, use safe and efficient work practices, maintain a hazard-free work area, accurately document and maintain information systems. This work would be carried out under routine supervision within organisational guidelines and applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to commission and decommission a range of security equipment and systems. It requires the ability to clearly identify and follow correct commissioning/decommissioning procedures, use safe and efficient work practices, maintain a hazard-free work area, accurately document and maintain information systems. This work would be carried out under routine supervision within organisational guidelines and applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for commissioning / decommissioning	<ul style="list-style-type: none"><li>1.1 Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements</li><li>1.2 Commissioning / decommissioning requirements of security equipment / systems are identified and confirmed in accordance with organisational procedures</li><li>1.3 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications and organisational procedures</li><li>1.4 Potential and existing risks and hazards associated with security equipment / systems are identified and managed in accordance with OHS policies and procedures and organisational requirements</li><li>1.5 Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements</li><li>1.6 Personal limitations in commissioning / decommissioning security equipment / systems are promptly identified and assistance is sought from appropriate person(s) in accordance with organisational procedures</li></ul>
2 Commission security equipment / system	<ul style="list-style-type: none"><li>2.1 Correct security equipment / system operational and testing procedures are observed and followed in accordance with manufacturer's specifications and work order</li><li>2.2 Testing confirms that security equipment / system meets installation performance specifications, industry and legislative requirements</li></ul>

- 2.3 Customisation of security equipment / system to match client requirements is completed as required in accordance with manufacturer's specifications and work order
  - 2.4 Malfunctions or deviations from specifications are identified and rectified or reported in accordance with organisational procedures
  - 2.5 Client hand-over of commissioned security equipment / system is undertaken in accordance with legislative and organisational requirements and relevant industry standards
  - 2.6 Safe operating practices are observed to remove risk of injury to self, others or security equipment / system in accordance with OHS and organisational requirements
- 3 Decommission security equipment / system
  - 3.1 Isolation procedures to protect the functioning or operation of existing structures are confirmed with appropriate person(s) and implemented in accordance with site procedures
  - 3.2 Security equipment / system to be decommissioned is accessed in accordance with manufacturer's specifications and minimises disruption to client, services or normal work routines
  - 3.3 Correct security equipment / system decommissioning procedures are observed and followed in accordance with manufacturer's specifications, OHS, legislative and organisational requirements
  - 3.4 Clear and concise communication is maintained with appropriate person(s) during decommissioning procedures in accordance with client and organisational requirements
  - 3.5 Safe operating practices are observed to remove risk of injury to self, others or security equipment / system in accordance with OHS and organisational requirements
- 4 Complete commissioning / decommissioning activities
  - 4.1 Removal of decommissioned security equipment / system or components is arranged in accordance with work order, OHS and organisational

procedures

- 4.2 Notification of work completion is made to appropriate person(s) in accordance with client and organisational procedures
- 4.3 Results of commissioning and other relevant documentation is completed and processed in accordance with industry, legislative and organisational requirements
- 4.4 Work area, tools and equipment are cleaned and stored in a secure and safe location in accordance with organisational requirements
- 4.5 Waste from commissioning / decommissioning activities is collected, treated and disposed of or recycled in accordance with organisational procedures and environmental policies

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to commission or decommission a range of security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### What critical aspects are required for evidence of competency?

Clearly identify commissioning/decommissioning requirements of security equipment/systems from work order and organise appropriate tools, equipment and materials to carry out work.

Follow safe and efficient work practices in the use of tools and equipment and accurately identify and manage risks and hazards to commissioning/decommissioning work and work areas.

Access security equipment/systems and methodically carry out commissioning/decommissioning procedures with minimal disruption to client services, existing structures or normal work routines.



Hand-over security equipment/system to client ensuring a full and complete understanding of equipment/system operations and functions through the provision of clear and effective instructions, information and/or training.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and prepare and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

types, functions and requirements of security equipment/systems

methods and procedures to commission/decommission security equipment/systems

security equipment/system configurations and programs

risks and hazards associated with commissioning/decommissioning work

types and functions of tools, equipment and testing devices

types and functions of keypad and control panels

earthing systems, arrangements and requirements

electrical concepts (voltage, current, resistance and impedance)

electrical connections and types of electrical circuits

cable identification and handling requirements

building construction methods and types

types and functions of computer software

technical terminology

procedures for working in confined spaces

organisational and client confidentiality requirements

OHS requirements and safe work practices

relevant legislative including Australian Standards, building codes and Australian Communications Authority (ACA) cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret plans and specifications

select and use suitable tools and equipment

methodically prioritise and organise work tasks

effectively operate security equipment/systems

download/upload information

test security equipment systems and read a multimeter

accurately identify and correctly handle cables  
customise equipment/systems to client requirements  
communicate in a clear and concise manner and provide effective training/instructions to clients  
safely disable security equipment/systems  
solder, weld and carry out basic carpentry  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1 - perform the process**

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

Clear instructions, explanations and training may be provided to clients to ensure a complete understanding of the functions and operations of security equipment/systems.

How can **information be collected, analysed and organised**? (2)

Test data may be interpreted and analysed to confirm commissioned security equipment/system meets installation performance specifications.

How are **activities planned and organised**? (2)

Access to security equipment/systems may be organised with minimal disruption to client services, existing structures or normal work routines.

How can **team work** be applied? (2)

Communication may be organised and maintained with relevant persons throughout decommissioning procedures.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Malfunctions or deficiencies in the performance or operational effectiveness of security equipment/system and/or components are promptly identified and reported for remedial action.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to commission or decommission a range of security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Clearly identify commissioning/decommissioning requirements of security equipment/systems from work order and organise appropriate tools, equipment and materials to carry out work.

Follow safe and efficient work practices in the use of tools and equipment and accurately identify and manage risks and hazards to commissioning/decommissioning work and work areas.

Access security equipment/systems and methodically carry out commissioning/decommissioning procedures with minimal disruption to client services, existing structures or normal work routines.

Hand-over security equipment/system to client ensuring a full and complete understanding of equipment/system operations and functions through the provision of clear and effective instructions, information and/or training.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and prepare and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

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methods and procedures to commission/decommission security equipment/systems

security equipment/system configurations and programs

risks and hazards associated with commissioning/decommissioning work

types and functions of tools, equipment and testing devices

types and functions of keypad and control panels

earthing systems, arrangements and requirements

electrical concepts (voltage, current, resistance and impedance)

electrical connections and types of electrical circuits

cable identification and handling requirements

building construction methods and types

types and functions of computer software

technical terminology

procedures for working in confined spaces

organisational and client confidentiality requirements

OHS requirements and safe work practices

relevant legislative including Australian Standards, building codes and Australian Communications Authority (ACA) cabling standards.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret plans and specifications

select and use suitable tools and equipment

methodically prioritise and organise work tasks

effectively operate security equipment/systems

download/upload information

test security equipment systems and read a multimeter

accurately identify and correctly handle cables  
customise equipment/systems to client requirements  
communicate in a clear and concise manner and provide effective training/instructions to clients  
safely disable security equipment/systems  
solder, weld and carry out basic carpentry  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

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Information below highlights how these processes are applied in this competency standard.

**1 - perform the process**

2 - perform and administer the process

3 - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

Clear instructions, explanations and training may be provided to clients to ensure a complete understanding of the functions and operations of security equipment/systems.

How can **information be collected, analysed and organised**? (2)

Test data may be interpreted and analysed to confirm commissioned security equipment/system meets installation performance specifications.

How are **activities planned and organised**? (2)

Access to security equipment/systems may be organised with minimal disruption to client services, existing structures or normal work routines.

How can **team work** be applied? (2)

Communication may be organised and maintained with relevant persons throughout decommissioning procedures.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Malfunctions or deficiencies in the performance or operational effectiveness of security equipment/system and/or components are promptly identified and reported for remedial action.

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Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

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**Work order information may relate to:**

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completion dates

job requirements and tasks

specific client requirements

access to site and specific site requirements

resource requirements

OHS requirements

compliance with relevant legislation

budget allocations

warranties and service information.

**Appropriate person(s) may include:**

clients

site managers

project managers

engineers and technicians

technical experts

line managers/supervisors

colleagues

regulatory personnel

security consultants.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures

operations manuals, induction and training materials

insurance policy agreements

client and organisational confidentiality requirements

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

OHS policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Commissioning requirements may relate to:**

equipment/system to be commissioned

persons to be trained

scheduling of commissioning  
information/documentation to be handed over to client  
customisation  
monitoring and response procedures to be determined/clarified.

**Decommissioning may involve:**

disconnection  
disablement  
hardware/software changes  
adjustments  
reconnecting components to ensure correct operation and compliance with building codes and regulations  
removal of components  
downloading system information  
default system-held information.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices  
cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Tools and equipment may include:**

multimeter, F-set, cable testing equipment



hand tools, power tools, fixing tools, crimp tools, IDS tools

flexible rods, fishing tools

strippers, router, file, followers, spirit level

soldering iron, welder

insulation mega

ladder, scaffold, scissor lift, hoist, drop sheet, batteries

personal protective equipment

communications equipment.

**Materials may include:**

computer disks

computer leads/cables

interface PCBs

keypads

handheld programmers

software.

**Risks and hazards may include:**

non-compliance with building codes and regulations

exposed electrical wiring

manual handling

chemical hazards (battery corrosion)

exposure to:

asbestos

dust

noise

live power

vermin

water

glass fibre

building debris

natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms

implementation of safety regulations

safety training

safety systems incorporating:  
work clearance procedures  
isolation procedures  
gas and vapour  
monitoring/testing procedures  
use of protective equipment and clothing

use of codes of practice.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
safety boots, knee pads  
gloves  
warning hats, flashing lights  
warning signs and tapes  
fire extinguisher  
first aid kit.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

Australian Standards, quality assurance, licensing and certification requirements  
relevant industry Codes of Practice  
trade practices, award and enterprise agreements  
privacy requirements, freedom of information.

**Customisation may involve:**

changing password or user code  
modifying system functions  
adding system functions

changing volume or length of alarms.

**Hand-over procedures may include:**

comprehensive explanation/demonstration of security equipment/system operations and functions

effective user training:

verbal and written explanations, demonstration, practice, question and answer session.

clear instructions on security equipment/system maintenance

provision of all relevant information and documentation:

manufacturer's and user manuals, maintenance requirements and contract, monitoring procedures and contract, keying plan, warranty requirements and contract, company contact details.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid.

**Removal may include:**

disconnection

dismantling

removal

reconnecting components to ensure correct operation and compliance with building codes and regulations.

**Results of commissioning may include:**

commissioning undertaken

persons equipment/system commissioned to

date and time of commissioning

information/documentation handed over to client

job card

customisation of equipment/system.

**Documentation may include:**

completion of work log

details of system decommissioning/commissioning

client approval for decommissioning

client sign-off for commissioning

adjustments made to security equipment/system

section lists, zone lists, equipment lists

fixings, job card

adjustments to original cable plan.

**Disposal may involve:**

return to client

destruction

return to manufacturer

special disposal requirements for hazardous components (radioactive components and batteries)

return to store

special storage and/or disposal requirements for classified or high security equipment/systems.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may relate to:**

work schedules

completion dates

job requirements and tasks

specific client requirements

access to site and specific site requirements

resource requirements

OHS requirements

compliance with relevant legislation

budget allocations

warranties and service information.

**Appropriate person(s) may include:**

clients

site managers

project managers

engineers and technicians  
technical experts  
line managers/supervisors  
colleagues  
regulatory personnel  
security consultants.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures  
operations manuals, induction and training materials  
insurance policy agreements  
client and organisational confidentiality requirements  
organisational goals, objectives, plans, systems and processes  
employer and employee rights and responsibilities  
own role, responsibility and delegation  
quality and continuous improvement processes and standards  
client service standards  
defined resource parameters  
OHS policies, procedures and programs  
emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Commissioning requirements may relate to:**

equipment/system to be commissioned  
persons to be trained  
scheduling of commissioning  
information/documentation to be handed over to client  
customisation  
monitoring and response procedures to be determined/clarified.

**Decommissioning may involve:**

disconnection  
disablement  
hardware/software changes

adjustments

reconnecting components to ensure correct operation and compliance with building codes and regulations

removal of components

downloading system information

default system-held information.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

smoke detection devices

electric/mechanical fire safety and fire locking systems

power supplies, batteries

security doors and door controls.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Tools and equipment may include:**

multimeter, F-set, cable testing equipment

hand tools, power tools, fixing tools, crimp tools, IDS tools

flexible rods, fishing tools

strippers, router, file, followers, spirit level

soldering iron, welder

insulation mega

ladder, scaffold, scissor lift, hoist, drop sheet, batteries

personal protective equipment

communications equipment.

**Materials may include:**

computer disks  
computer leads/cables  
interface PCBs  
keypads  
handheld programmers  
software.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
exposed electrical wiring  
manual handling  
chemical hazards (battery corrosion)  
exposure to:  
asbestos  
dust  
noise  
live power  
vermin  
water  
glass fibre  
building debris  
natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms  
implementation of safety regulations  
safety training  
safety systems incorporating:  
work clearance procedures  
isolation procedures  
gas and vapour  
monitoring/testing procedures  
use of protective equipment and clothing  
  
use of codes of practice.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
safety boots, knee pads  
gloves  
warning hats, flashing lights  
warning signs and tapes  
fire extinguisher  
first aid kit.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

Australian Standards, quality assurance, licensing and certification requirements  
relevant industry Codes of Practice  
trade practices, award and enterprise agreements  
privacy requirements, freedom of information.

**Customisation may involve:**

changing password or user code  
modifying system functions  
adding system functions  
changing volume or length of alarms.

**Hand-over procedures may include:**

comprehensive explanation/demonstration of security equipment/system operations and functions  
effective user training:  
verbal and written explanations, demonstration, practice, question and answer session.  
  
clear instructions on security equipment/system maintenance



provision of all relevant information and documentation:

manufacturer's and user manuals, maintenance requirements and contract, monitoring procedures and contract, keying plan, warranty requirements and contract, company contact details.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid.

**Removal may include:**

disconnection

dismantling

removal

reconnecting components to ensure correct operation and compliance with building codes and regulations.

**Results of commissioning may include:**

commissioning undertaken

persons equipment/system commissioned to

date and time of commissioning

information/documentation handed over to client

job card

customisation of equipment/system.

**Documentation may include:**

completion of work log

details of system decommissioning/commissioning

client approval for decommissioning

client sign-off for commissioning

adjustments made to security equipment/system

section lists, zone lists, equipment lists

fixings, job card

adjustments to original cable plan.

**Disposal may involve:**

return to client

destruction

return to manufacturer

special disposal requirements for hazardous components (radioactive components and batteries)

return to store

special storage and/or disposal requirements for classified or high security equipment/systems.

## **Unit Sector(s)**

Not applicable.

## **PRSTS305A Identify and diagnose electronic security equipment/system fault**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to identify and diagnose faults in electronic security equipment/systems. It requires the ability to ascertain normal operational functions and performance of a range of security equipment/systems, conduct fault-finding inspections and checks, systematically identify and diagnose faults, and accurately document and maintain information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to identify and diagnose faults in electronic security equipment/systems. It requires the ability to ascertain normal operational functions and performance of a range of security equipment/systems, conduct fault-finding inspections and checks, systematically identify and diagnose faults, and accurately document and maintain information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for diagnosis of faults	<ul style="list-style-type: none"><li>1.1 Work order is reviewed and clarified with appropriate person(s) as required in accordance with organisational requirements</li><li>1.2 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications and organisational procedures</li><li>1.3 Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements</li><li>1.4 Potential and existing risks and hazards associated with security equipment / systems are identified and managed in accordance with OHS and organisational requirements</li><li>1.5 Site access and specific site requirements are identified and appropriate arrangements made as required in accordance with client and organisational requirements</li></ul>
2 Diagnose faults	<ul style="list-style-type: none"><li>2.1 Safe operating practices are followed to remove risk of injury to self, others or security equipment / system in accordance with OHS and organisational requirements</li><li>2.2 Reported faults are confirmed and normal operational functions and performance of security equipment / systems are ascertained in accordance with manufacturer's specifications</li><li>2.3 Operational data and relevant information is accessed and appropriate inspections and tests are carried out in accordance with manufacturer's specifications and relevant industry standards</li></ul>

- 2.4 Faults are systematically identified and diagnosed on the basis of an accurate assessment of inspection and test results, operational data and relevant information
- 2.5 Personal limitations in identifying and diagnosing faults are promptly identified and assistance is sought from appropriate person(s) in accordance with organisational procedures
- 3 Complete and report diagnosis
  - 3.1 Work is completed in an efficient and timely manner in accordance with work order and organisational requirements
  - 3.2 Notification of work completion is made to appropriate person(s) in accordance with organisational procedures
  - 3.3 Documentation is completed promptly and accurately and processed in accordance with client, legislative and organisational requirements
  - 3.4 Work area, tools and equipment are cleaned and stored in a secure and safe location in accordance with organisational requirements
  - 3.5 Waste from work activities is collected, treated and disposed of or recycled in accordance with organisational procedures and environmental policies

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to identify and diagnose electronic security equipment/system faults. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### What critical aspects are required for evidence of competency?

Clearly identify job requirements and organise appropriate tools, equipment and materials to carry out checks and testing of a range of security equipment and systems.

Confirm reported faults with client and ascertain normal performance of security equipment/system against manufacturer's specifications.

Follow safe and efficient work practices in the use of tools and equipment and effectively manage risks and hazards in the work area.

Conduct inspections and tests of security equipment/systems in a methodical manner and accurately identify and diagnose faults based on an assessment of test data, site variables, operational and historical information.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and update and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

types, functions and specifications of security equipment/systems

operational principles of security equipment/systems

operational principles of data transmission networks

basics of circuit diagrams

electrical connections

electrical concepts (voltage, current, resistance and impedance)

common test equipment

tests to confirm equipment/system operation

fault finding techniques

common equipment/system faults

technical terms

common security equipment/system faults

building construction methods and types

cable identification and handling requirements

earthing systems arrangements and requirements

confined space procedures.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret specifications, charts and diagrams

communicate in a clear and concise manner

demonstrate basic logic and lateral thinking processes

use appropriate tools and equipment

test security equipment/systems  
read and interpret a multimeter  
accurately identify and diagnose faults  
identify and correctly handle cables  
carry out soldering, welding, drilling and basic carpentry  
work in confined spaces  
methodically prioritise and organise work tasks  
solve routine problems and trouble shoot  
estimate resource requirements  
apply safe and efficient work practices  
prepare orders, invoices and supply requisitions.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

Reported faults of security equipment/system may be verified in consultation with relevant persons.

How can **information be collected, analysed and organised**? (2)

Results of conducted inspections and tests may be accurately documented and organised in reports for analysis.

How are **activities planned and organised**? (2)

Fault-finding tests may be carried out systematically to ensure fault is effectively isolated and identified.

How can **team work** be applied? (2)

Personal limitations in identifying and diagnosing faults may be promptly identified and assistance sought from relevant persons.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Hazards and risks in the work area may be promptly identified and controlled to ensure safety of self, property and others.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to identify and diagnose electronic security equipment/system faults. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Clearly identify job requirements and organise appropriate tools, equipment and materials to carry out checks and testing of a range of security equipment and systems.

Confirm reported faults with client and ascertain normal performance of security equipment/system against manufacturer's specifications.

Follow safe and efficient work practices in the use of tools and equipment and effectively manage risks and hazards in the work area.



Conduct inspections and tests of security equipment/systems in a methodical manner and accurately identify and diagnose faults based on an assessment of test data, site variables, operational and historical information.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and update and submit all required documentation in an accurate and prompt manner.

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operational principles of security equipment/systems

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basics of circuit diagrams

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common test equipment

tests to confirm equipment/system operation

fault finding techniques

common equipment/system faults

technical terms

common security equipment/system faults

building construction methods and types

cable identification and handling requirements

earthing systems arrangements and requirements

confined space procedures.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret specifications, charts and diagrams

communicate in a clear and concise manner

demonstrate basic logic and lateral thinking processes

use appropriate tools and equipment

test security equipment/systems

read and interpret a multimeter

accurately identify and diagnose faults

identify and correctly handle cables

carry out soldering, welding, drilling and basic carpentry

work in confined spaces

methodically prioritise and organise work tasks

solve routine problems and trouble shoot

estimate resource requirements

apply safe and efficient work practices

prepare orders, invoices and supply requisitions.

### **What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

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### **Key competency levels**

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**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

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How can **information be collected, analysed and organised**? (2)

Results of conducted inspections and tests may be accurately documented and organised in reports for analysis.

How are **activities planned and organised**? (2)

Fault-finding tests may be carried out systematically to ensure fault is effectively isolated and identified.

How can **team work** be applied? (2)

Personal limitations in identifying and diagnosing faults may be promptly identified and assistance sought from relevant persons.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks.

How can **problem solving skills** be applied? (2)

Hazards and risks in the work area may be promptly identified and controlled to ensure safety of self, property and others.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### **Work order information may relate to:**

work schedules

completion dates

job requirements and tasks

specific client requirements

access to site and specific site requirements

resource requirements

OHS requirements

compliance with relevant legislation

budget allocations

warranties and service information.

**Appropriate person(s) may include:**

clients

site managers, project managers

engineers and technicians

technical experts

line managers/supervisors

colleagues, security consultants

regulatory personnel.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures

operations manuals, induction and training materials

insurance policy agreements

client and organisational confidentiality requirements

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

OHS policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Tools and equipment may include:**

computer, software, back-up disks

test equipment (multimeter)

hand tools, fixing tools, crimp tools, IDC tools

strippers, router, file, drill, power saw

lockpick, pick gun, followers

glass break tester, spirit level

soldering iron, welder

ladder, hoist, drop sheet, batteries  
personal protective equipment  
communications equipment.

**Materials may include:**

computer disks  
circuit board cleaner  
computer cables/leads  
software  
interface PCBs.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
safety boots, knee pads  
gloves  
warning hats, flashing lights  
warning signs and tapes  
fire extinguisher  
first aid kit.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
exposed electrical wiring  
manual handling  
chemical hazards (battery corrosion)  
exposure to:  
asbestos  
dust  
noise  
live power  
vermin  
water  
glass fibre  
building debris  
natural and other gas build-up.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Site access and specific site requirements may relate to:**

access and egress points, time of access  
access codes, keys, passes, security clearances  
union requirements  
OHS requirements  
building codes and regulations  
heritage listings  
noise control.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines  
working safely around tools and equipment  
hazard recognition  
emergency procedures  
awareness of electrical hazards  
following confined spaces procedures  
administering first aid.

**Faults may be:**

electronic, mechanical, procedural

software related

due to operational misuse

environmental

due to previous installation.

**Operational data may be found in:**

central monitoring station records

maintenance documentation

manufacturer's specifications

visual inspections

software records

back-ups.

**Relevant information may include:**

site variables:

equipment/system usage

environmental conditions

building structures

client habits

historical information of past performance

operational data.

**Inspections may involve:**

a visual inspection of:

equipment/system malfunctioning

parts and components

mechanisms

connections

using computer tools

client demonstration

environmental assessment.

**Systematic fault-finding may involve:**

using a methodical approach

progressively isolating fault

using testing equipment

verifies continued existence of problem  
reviews all available information  
identifies fault in shortest time possible.

**Documentation may detail:**

completion of work log  
equipment/system problem  
fault diagnosis  
warranty conditions and allowances  
recommendations for repair  
circuit diagrams and flow charts  
keying plans.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements and related legislation.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Work order information may relate to:**

work schedules  
completion dates  
job requirements and tasks  
specific client requirements



access to site and specific site requirements

resource requirements

OHS requirements

compliance with relevant legislation

budget allocations

warranties and service information.

**Appropriate person(s) may include:**

clients

site managers, project managers

engineers and technicians

technical experts

line managers/supervisors

colleagues, security consultants

regulatory personnel.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures

operations manuals, induction and training materials

insurance policy agreements

client and organisational confidentiality requirements

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

OHS policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Tools and equipment may include:**

computer, software, back-up disks

test equipment (multimeter)

hand tools, fixing tools, crimp tools, IDC tools

strippers, router, file, drill, power saw

lockpick, pick gun, followers

glass break tester, spirit level

soldering iron, welder

ladder, hoist, drop sheet, batteries

personal protective equipment

communications equipment.

**Materials may include:**

computer disks

circuit board cleaner

computer cables/leads

software

interface PCBs.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs

safety boots, knee pads

gloves

warning hats, flashing lights

warning signs and tapes

fire extinguisher

first aid kit.

**Risks and hazards may include:**

non-compliance with building codes and regulations

exposed electrical wiring

manual handling

chemical hazards (battery corrosion)

exposure to:

asbestos

dust

noise

live power

vermin

water

glass fibre

building debris

natural and other gas build-up.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

smoke detection devices

electric/mechanical fire safety and fire locking systems

power supplies, batteries

security doors and door controls.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Site access and specific site requirements may relate to:**

access and egress points, time of access

access codes, keys, passes, security clearances

union requirements

OHS requirements

building codes and regulations

heritage listings

noise control.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards  
following confined spaces procedures  
administering first aid.

**Faults may be:**

electronic, mechanical, procedural  
software related  
due to operational misuse  
environmental  
due to previous installation.

**Operational data may be found in:**

central monitoring station records  
maintenance documentation  
manufacturer's specifications  
visual inspections  
software records  
back-ups.

**Relevant information may include:**

site variables:  
equipment/system usage  
environmental conditions  
building structures  
client habits

historical information of past performance  
operational data.

**Inspections may involve:**

a visual inspection of:  
equipment/system malfunctioning  
parts and components  
mechanisms  
connections

using computer tools  
client demonstration

environmental assessment.

**Systematic fault-finding may involve:**

using a methodical approach

progressively isolating fault

using testing equipment

verifies continued existence of problem

reviews all available information

identifies fault in shortest time possible.

**Documentation may detail:**

completion of work log

equipment/system problem

fault diagnosis

warranty conditions and allowances

recommendations for repair

circuit diagrams and flow charts

keying plans.

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations

compliance with Australian Communications Authority (ACA) cabling standards

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety and safe work practices

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements and related legislation.

**Unit Sector(s)**

Not applicable.



## **PRSTS307A Maintain and service security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to carry out routine servicing and repairs of a range of security equipment, systems, plant and equipment. It requires the ability to identify maintenance requirements, follow correct procedures, use safe and efficient work practices, maintain a hazard-free work area, accurately document and maintain information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

This competency standard covers the skills and knowledge required to carry out routine servicing and repairs of a range of security equipment, systems, plant and equipment. It requires the ability to identify maintenance requirements, follow correct procedures, use safe and efficient work practices, maintain a hazard-free work area, accurately document and maintain information systems. This work applies in extra low voltage as defined through the Australian Standards As 2201 (1986) environments and would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Core, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

## Elements and Performance Criteria Pre-Content

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for maintenance	<p>1.1 Maintenance requirements of security equipment / systems are confirmed against work order</p> <p>1.2 Types of security equipment / systems to be inspected, serviced and / or repaired are identified and checked against work order</p> <p>1.3 Tools, equipment and materials are selected appropriate to job requirements and checked for operational effectiveness in accordance with manufacturer's specifications</p> <p>1.4 Faulty or unsafe tools are identified and segregated for repair or replacement in accordance with organisational procedures</p> <p>1.5 Potential and existing risks and hazards associated with maintenance activities are identified and controlled in accordance with OHS policies and procedures and organisational requirements</p> <p>1.6 Suitable personal protective equipment is selected, used and maintained in accordance with OHS and organisational requirements</p>
2 Carry out service and repair of security equipment / systems	<p>2.1 All work is conducted using safe operating practices in accordance with OHS, legislative and organisational requirements</p> <p>2.2 Security equipment / systems identified for maintenance are accessed with minimal disruption to client, services or normal work routines</p> <p>2.3 Inspections and checks are conducted to identify any damage, obstruction or component wear in accordance with manufacturer's specifications and OHS requirements</p> <p>2.4 Security equipment / systems are serviced and</p>



- repaired in accordance with manufacturer's specifications, work order and OHS requirements
- 2.5 Complex faults or repair requirements outside area of responsibility or competence are reported to appropriate person(s) for specialist advice in accordance with organisational procedures
- 3 Complete maintenance activities
- 3.1 Serviced and / or repaired security equipment / systems are checked and confirmed for correct operation and serviceability in accordance with manufacturer's specifications and OHS requirements
- 3.2 Relevant documentation is promptly and accurately completed and processed in accordance with industry, legislative and organisational requirements
- 3.3 Work area, tools and equipment are cleaned and stored in accordance with OHS and organisational requirements
- 3.4 Malfunctions, faults, wear or damage to tools is reported for repair or replacement in accordance with organisational policy and procedures
- 3.5 Waste from service and repair activities is collected, treated and disposed or recycled in accordance with organisational and environmental requirements

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to maintain and service security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

**What critical aspects are required for evidence of competency?**

Clearly identify maintenance requirements of security equipment/systems and organise appropriate tools, equipment and materials to carry out work.

Follow safe and efficient work practices in the use of tools and equipment and accurately identify and manage risks and hazards to maintenance work and work areas.

Access security equipment/systems and methodically carry out maintenance procedures appropriate to the security equipment or system with minimal disruption to client, services or normal work routines.

Clean and store tools and equipment, reinstate work area in a clear and safe condition, and update and submit all required documentation in an accurate and prompt manner.

**What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

types, functions and specifications of security equipment/systems and plant and equipment

operational principles of security equipment/systems

security equipment/system maintenance requirements

spare parts availability and supply

equipment calibration requirements

maintenance schedules

technical terms

common security equipment/system faults

tests to confirm equipment/system operation

building construction methods and types

electrical concepts

cable identification and handling requirements

earthing systems arrangements and requirements

confined space procedures.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

read and interpret specifications, charts and diagrams

communicate in a clear and concise manner

use appropriate testing tools and equipment

use appropriate maintenance equipment

service and repair security equipment/systems and plant and equipment

test security equipment/systems

read and interpret a multimeter  
identify faults  
identify and correctly handle cables  
work in confined spaces  
methodically prioritise and organise work tasks  
solve routine problems  
estimate resource requirements  
apply safe and efficient work practices  
prepare orders, invoices and supply requisitions.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.  
Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1 - perform the process**

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? (2)

Maintenance requirements of security equipment/systems may be clarified with relevant persons

How can **information be collected, analysed and organised**? (2)

Results of conducted inspections and checks may be accurately documented and organised in reports for review.

How are **activities planned and organised**? (2)

Access to security equipment/systems may be organised with minimal disruption to client, services or normal work routines.

How can **team work** be applied? (2)

Team work may be applied in methods and procedures to complete maintenance tasks within designated timeframes.

How can the use of **mathematical ideas and techniques** be applied? (2)

Mathematical techniques may be used to accurately estimate resource requirements and prioritise work tasks

How can **problem solving skills** be applied?(2)

Complex faults or repair requirements may be accurately identified and promptly reported for specialist advice.

How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to maintain and service security equipment and systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

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equipment calibration requirements  
maintenance schedules  
technical terms  
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test security equipment/systems  
read and interpret a multimeter  
identify faults  
identify and correctly handle cables  
work in confined spaces  
methodically prioritise and organise work tasks  
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estimate resource requirements  
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Access to a suitable venue and equipment.

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How can the **use of technology** be applied? (2)

Technology may be used to communicate, source and record information. It may also be used to carry out testing activities.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### **Maintenance may include:**

inspections, lubrication, cleaning and adjustments

routine repairs

identification and replacement of worn parts

confirmation of operational effectiveness

back-ups

changing user codes.

### **Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

smoke detection devices  
electric/mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Equipment may include:**

personal protective equipment  
electronic instruments and equipment  
diagnostics and testing equipment  
installation tools and equipment  
staple guns, ladders, cherrypickers  
generators, extension cords, torches and lighting  
mobile phones and communications equipment  
cameras, computers  
motor vehicles.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Work order information may include:**

work schedules and completion dates  
job requirements and tasks  
specific client requirements  
access to site and specific site requirements  
resource requirements  
OHS requirements  
compliance with relevant legislation  
budget allocations  
warranties and service information.



**Tools and equipment may include:**

compute, software, back-up disks  
test equipment (multimeter)  
hand tools, fixing tools, crimp tools, IDC tools  
strippers, router, file, drill, power saw  
lockpick, pick gun, followers  
glass break tester, spirit level  
soldering iron, welder  
ladder, hoist, drop sheet, batteries  
personal protective equipment  
communications equipment.

**Materials may include:**

resistors, parts and components  
wire and cable, fixings, solder, insulation tape  
springs, pins, oil, silicon, grease  
glass cleaner/lens cleaner  
glue, paint, patch materials  
sealing compound, cleaning compounds  
electronic components.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
exposed electrical wiring  
manual handling  
chemical hazards (battery corrosion)  
exposure to:  
asbestos  
dust  
noise  
live power  
vermin  
water  
glass fibre  
building debris  
natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms  
 implementation of safety regulations  
 safety training  
 safety systems incorporating:  
 work clearance procedures  
 isolation procedures  
 gas and vapour  
 monitoring/testing procedures  
 use of protective equipment and clothing

use of codes of practice.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures  
 operations manuals, induction and training materials  
 insurance policy agreements  
 client and organisational confidentiality requirements  
 organisational goals, objectives, plans, systems and processes  
 employer and employee rights and responsibilities  
 own role, responsibility and delegation  
 quality and continuous improvement processes and standards  
 client service standards  
 defined resource parameters  
 OHS policies, procedures and programs  
 emergency and evacuation procedures  
 duty of care, code of conduct, code of ethics  
 access and equity policy, principles and practice  
 records and information systems and processes  
 communication channels and reporting procedures.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
 safety boots, knee pads  
 gloves  
 witches hats, flashing lights

warning signs and tapes

fire extinguisher

first aid kit.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

following confined spaces procedures

administering first aid .

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations

compliance with Australian Communications Authority (ACA) cabling standards

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety and safe work practices

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

trade practices, award and enterprise agreements

privacy requirements, freedom of information.

**Access may involve:**

use of access code

disablement of system

removal of housing

access token, keys

phone line access, modem.

**Disruptions may affect:**

security

time

access

noise

use of communications equipment

business operations.

**Appropriate person(s) may include:**

clients

site managers

project managers

engineers and technicians

technical experts

line managers/supervisors

colleagues

regulatory personnel

security consultants.

**Documentation may relate to:**

work log

service/maintenance records

equipment/system problems/faults

warranty conditions and allowances

recommendations for repairs

operational checks and maintenance conducted

testing and commissioning results

parts and components replaced, materials used

costings, receipts, invoice.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Maintenance may include:**

inspections, lubrication, cleaning and adjustments

routine repairs

identification and replacement of worn parts

confirmation of operational effectiveness

back-ups

changing user codes.

**Security equipment and systems may include:**

detection devices, audible/visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

smoke detection devices

electric/mechanical fire safety and fire locking systems

power supplies, batteries

security doors and door controls.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Equipment may include:**

personal protective equipment

electronic instruments and equipment

diagnostics and testing equipment

installation tools and equipment

staple guns, ladders, cherrypickers

generators, extension cords, torches and lighting

mobile phones and communications equipment

cameras, computers

motor vehicles.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Work order information may include:**

work schedules and completion dates  
 job requirements and tasks  
 specific client requirements  
 access to site and specific site requirements  
 resource requirements  
 OHS requirements  
 compliance with relevant legislation  
 budget allocations  
 warranties and service information.

**Tools and equipment may include:**

compute, software, back-up disks  
 test equipment (multimeter)  
 hand tools, fixing tools, crimp tools, IDC tools  
 strippers, router, file, drill, power saw  
 lockpick, pick gun, followers  
 glass break tester, spirit level  
 soldering iron, welder  
 ladder, hoist, drop sheet, batteries  
 personal protective equipment  
 communications equipment.

**Materials may include:**

resistors, parts and components  
 wire and cable, fixings, solder, insulation tape  
 springs, pins, oil, silicon, grease  
 glass cleaner/lens cleaner  
 glue, paint, patch materials  
 sealing compound, cleaning compounds  
 electronic components.

**Risks and hazards may include:**

non-compliance with building codes and regulations  
 exposed electrical wiring  
 manual handling  
 chemical hazards (battery corrosion)

exposure to:

asbestos

dust

noise

live power

vermin

water

glass fibre

building debris

natural and other gas build-up.

**OHS policies and procedures may relate to:**

hazardous and risk assessment mechanisms

implementation of safety regulations

safety training

safety systems incorporating:

work clearance procedures

isolation procedures

gas and vapour

monitoring/testing procedures

use of protective equipment and clothing

use of codes of practice.

**Organisational requirements may relate to:**

legal and organisational operational policies and procedures

operations manuals, induction and training materials

insurance policy agreements

client and organisational confidentiality requirements

organisational goals, objectives, plans, systems and processes

employer and employee rights and responsibilities

own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

OHS policies, procedures and programs

emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Personal protective clothing and equipment may include:**

masks, safety glasses, head protection, ear muffs  
safety boots, knee pads  
gloves  
warning hats, flashing lights  
warning signs and tapes  
fire extinguisher  
first aid kit.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines  
working safely around tools and equipment  
hazard recognition  
emergency procedures  
awareness of electrical hazards  
following confined spaces procedures  
administering first aid .

**Applicable legislation, codes and national standards may relate to:**

compliance with Australian building codes and regulations  
compliance with Australian Communications Authority (ACA) cabling standards  
relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety and safe work practices  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity  
  
licensing arrangements  
Australian Standards, quality assurance and certification requirements  
relevant industry Codes of Practice



trade practices, award and enterprise agreements  
privacy requirements, freedom of information.

**Access may involve:**

use of access code  
disablement of system  
removal of housing  
access token, keys  
phone line access, modem.

**Disruptions may affect:**

security  
time  
access  
noise  
use of communications equipment  
business operations.

**Appropriate person(s) may include:**

clients  
site managers  
project managers  
engineers and technicians  
technical experts  
line managers/supervisors  
colleagues  
regulatory personnel  
security consultants.

**Documentation may relate to:**

work log  
service/maintenance records  
equipment/system problems/faults  
warranty conditions and allowances  
recommendations for repairs  
operational checks and maintenance conducted  
testing and commissioning results  
parts and components replaced, materials used

costings, receipts, invoice.

## **Unit Sector(s)**

Not applicable.

## **PRSTS317A Provide estimate and quote**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the process of providing an estimate and quote on security systems to clients. It requires the ability to identify the needs of clients and prepare an accurate quote which provides full details of security equipment and system provisions. Competency also requires a knowledge of interpreting plans, designs and specifications and calculating labour and material costs. These work functions would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Elective, Technical Security

This competency standard covers the process of providing an estimate and quote on security systems to clients. It requires the ability to identify the needs of clients and prepare an accurate quote which provides full details of security equipment and system provisions. Competency also requires a knowledge of interpreting plans, designs and specifications and calculating labour and material costs. These work functions would be carried out under routine supervision within organisational guidelines.

**Functional Area:** Elective, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

# Elements and Performance Criteria

## Elements and Performance Criteria

Element	Performance Criteria
1 Identify customer needs	<ul style="list-style-type: none"><li>1.1 Security assessment is undertaken in accordance with organisational requirements to determine client requirements</li><li>1.2 Specialised system requirements of clients are identified and installation requirements are considered in accordance with legislative and organisational requirements</li><li>1.3 Occupational Health and Safety standards, statutory requirements, Australian Standards, manufacturers specifications and organisational requirements are interpreted</li><li>1.4 Appropriate plans, drawings and texts are interpreted in order to identify correct size, type and quantity of material and equipment for estimation</li><li>1.5 Ability to provide client security system is assessed in accordance with client security requirements and organisational and legal requirements</li></ul>
2 Estimate costs	<ul style="list-style-type: none"><li>2.1 Organisation's rate schedules and / or industry based labour rates and conditions are identified and applied to establish costings according to organisational policy and procedures</li><li>2.2 Where equipment or materials are to be obtained from a supplier, quotations are obtained to ensure fair comparisons between suppliers</li><li>2.3 Equipment, materials and other relevant items availability and delivery dates are confirmed with supplier, where required</li><li>2.4 Site inspection is carried out to identify installation method and possible problems are considered and allowances for contingencies are made based on findings</li><li>2.5 Costs estimated plan to return a profit on provision of security systems to client requirements where</li></ul>

appropriate

- |  |  |
|--|--|
| 3 Document and confirm quotation with client | 3.1 Quotation is prepared providing clear and concise information including all details of security system to be provided in accordance with organisational requirements |
|  | 3.2 Quotation is presented promptly to client which reflects client security requirements according to organisational requirements and accepted timeframes               |
|  | 3.3 Client is consulted and any changes or variations are negotiated to meet client and organisational requirements  |
|  | 3.4 Client file is created and required documentation is accurately updated to include all relevant details in accordance with organisational policy and procedures      |

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to provide an estimate and quote on security systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### What critical aspects are required for evidence of competency?

Determine security equipment requirements for provision of security system.

Determine prices and estimates for labour, equipment, materials and other relevant items.

Determine availability of equipment/materials.

Calculate estimations to return a profit where appropriate.

Ensure estimates allow for provision of security system which meets client requirements.

Prepare accurate quotes for clients which provide full details of security equipment/system provision.

### What specific knowledge is needed to achieve the performance criteria?

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

legislation and regulations applicable to quoting and providing security equipment/system services

organisational policies and procedures (personal presentation, documentation procedures, records and information systems)

types and functions of security equipment and systems

requirements of company pricing including schedules, policy and procedures

computer applications in relation to costing

contractual requirements for estimating and quoting for service provision

principles of duty of care, code of conduct and code of ethics

organisational policies and procedures related to the analysis of client requirements and selection of services

rights and responsibilities of customers.

### **What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

accurately record and report information

present a professional image to members of the public and colleagues

apply active listening and questioning techniques

handle customer complaints courteously

communicate effectively with and relate to people from different social, cultural and ethnic backgrounds and of varying physical and mental abilities

calculate time, measurements and quantities

operate a computer

read and interpret plans, designs and specifications

organise work utilising time management skills

comply with relevant legislative and regulatory requirements.

### **What resources may be required for assessment?**

Access to a suitable venue and access to designs and specifications, unit prices of equipment, materials and labour to make an estimate.

Case studies.

Occupational Health and Safety guidelines.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

**What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

**Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

**Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(2)**

Information and ideas with regard to developing an understanding of client expectations and requirements may be shared and discussed with colleagues, supervisor and/or clients.

How can **information be collected, analysed and organised**? **(2)**

Occupational Health and Safety standards, quality assurance requirements, manufacturers specifications and organisational policy and procedures may be accessed to ensure compliance.

How are **activities planned and organised**? **(2)**

Work tasks may be prioritised and coordinated or sequenced as required to ensure availability of materials and meet agreed completion dates.

How can **team work** be applied? **(2)**

Assistance may be provided among team members to carry out and fulfil quotation requirements.

How can the use of **mathematical ideas and techniques** be applied? **(2)**

Mathematics may be applied as an aid to measure and calculate materials and labour.

How can **problem solving skills** be applied? (2)

In the application of skills and knowledge to identify and resolve client complaints or to recognise service delivery complications.

How can the **use of technology** be applied? (1)

To access company pricing schedules and company pro-formas for the preparation of estimates and quotes.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to provide an estimate and quote on security systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

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computer applications in relation to costing

contractual requirements for estimating and quoting for service provision

principles of duty of care, code of conduct and code of ethics

organisational policies and procedures related to the analysis of client requirements and selection of services

rights and responsibilities of customers.

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present a professional image to members of the public and colleagues

apply active listening and questioning techniques

handle customer complaints courteously

communicate effectively with and relate to people from different social, cultural and ethnic backgrounds and of varying physical and mental abilities

calculate time, measurements and quantities

operate a computer

read and interpret plans, designs and specifications

organise work utilising time management skills

comply with relevant legislative and regulatory requirements.

### **What resources may be required for assessment?**

Access to a suitable venue and access to designs and specifications, unit prices of equipment, materials and labour to make an estimate.

Case studies.

Occupational Health and Safety guidelines.

Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(2)**

Information and ideas with regard to developing an understanding of client expectations and requirements may be shared and discussed with colleagues, supervisor and/or clients.

How can **information be collected, analysed and organised**? **(2)**

Occupational Health and Safety standards, quality assurance requirements, manufacturers specifications and organisational policy and procedures may be accessed to ensure compliance.

How are **activities planned and organised**? **(2)**

Work tasks may be prioritised and coordinated or sequenced as required to ensure availability of materials and meet agreed completion dates.

How can **team work** be applied? **(2)**

Assistance may be provided among team members to carry out and fulfil quotation requirements.

How can the use of **mathematical ideas and techniques** be applied? **(2)**

Mathematics may be applied as an aid to measure and calculate materials and labour.

How can **problem solving skills** be applied? **(2)**

In the application of skills and knowledge to identify and resolve client complaints or to recognise service delivery complications.

How can the **use of technology** be applied? **(1)**

To access company pricing schedules and company pro-formas for the preparation of estimates and quotes.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### Assessment may involve

discussions with client

visual inspections

review of client floor plans and supporting documentation  
questioning police, insurance companies and other bodies.

**Clients may include:**

property agent  
tenant  
building supervisor  
project manager  
corporations  
general public  
government agencies.

**Specialist system requirements may be:**

use of special tools  
system manuals and documentation  
product training  
software/hardware development.

**Installation requirements may be:**

use of special tools or equipment (e.g. drill, ladder, scaffolding, cherry picker  
sub-contract labour.

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing arrangements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

award and enterprise agreements

trade practices

privacy requirements.

**Organisational requirements may relate to:**

legal and organisational policy and procedures including personnel practices and guidelines

organisational goals, objectives, plans, systems and processes  
legislation relevant to the operation, incident and/or response  
employer and employee rights and responsibilities  
business and performance plans  
policies and procedures relating to own role, responsibility and delegation  
quality and continuous improvement processes and standards  
client service standards  
defined resource parameters  
Occupational Health and Safety policies, procedures and programs  
emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice  
records and information systems and processes  
communication channels and reporting procedures.

**Manufacturers specifications may be found in:**

printed instruction leaflets  
operators manuals  
equipment specifications  
attachments to equipment  
plans and diagrams  
warranty documents.

**Security systems may be:**

electronic  
mechanical  
computerised  
procedural.

**Rate schedules may include:**

labour rates  
standard unit costs  
standard equipment costs  
standard materials costs  
standard installation costs  
standard service costs  
standard monitoring costs.

**Possible problems may include:**

insurance  
time penalties  
disputes  
availability  
delivery  
competencies  
restricted site access  
building progress  
weather and environmental conditions  
cash flow.

**Quotations are written and may include:**

company identification information  
results of security assessment  
client brief  
recommended security system and agreed security system  
system capabilities  
system specifications and configuration  
equipment and/or system type  
equipment locations and positions  
service and maintenance  
limits of system  
costs, timelines, warranty/guarantee/liability terms and conditions if applicable  
suitable sign-off arrangements by company and client  
terms of trade.

**Changes or variations may include:**

changes and variations in cost, equipment, services  
changes and variations in installation, monitoring  
changes and variations in starting and/or completion dates  
variations of warranty/guarantee/liability terms and conditions  
variations in exclusions and terms of trade.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Assessment may involve**

discussions with client  
visual inspections  
review of client floor plans and supporting documentation  
questioning police, insurance companies and other bodies.

**Clients may include:**

property agent  
tenant  
building supervisor  
project manager  
corporations  
general public  
government agencies.

**Specialist system requirements may be:**

use of special tools  
system manuals and documentation  
product training  
software/hardware development.

**Installation requirements may be:**

use of special tools or equipment (e.g. drill, ladder, scaffolding, cherry picker  
sub-contract labour.

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety  
environmental issues  
equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing arrangements  
Australian Standards, quality assurance and certification requirements  
relevant industry Codes of Practice  
award and enterprise agreements  
trade practices

privacy requirements.

**Organisational requirements may relate to:**

legal and organisational policy and procedures including personnel practices and guidelines

organisational goals, objectives, plans, systems and processes

legislation relevant to the operation, incident and/or response

employer and employee rights and responsibilities

business and performance plans

policies and procedures relating to own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

Occupational Health and Safety policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Manufacturers specifications may be found in:**

printed instruction leaflets

operators manuals

equipment specifications

attachments to equipment

plans and diagrams

warranty documents.

**Security systems may be:**

electronic

mechanical

computerised

procedural.

**Rate schedules may include:**

labour rates

standard unit costs

standard equipment costs

standard materials costs

standard installation costs

standard service costs

standard monitoring costs.

**Possible problems may include:**

insurance

time penalties

disputes

availability

delivery

competencies

restricted site access

building progress

weather and environmental conditions

cash flow.

**Quotations are written and may include:**

company identification information

results of security assessment

client brief

recommended security system and agreed security system

system capabilities

system specifications and configuration

equipment and/or system type

equipment locations and positions

service and maintenance

limits of system

costs, timelines, warranty/guarantee/liability terms and conditions if applicable

suitable sign-off arrangements by company and client

terms of trade.

**Changes or variations may include:**

changes and variations in cost, equipment, services

changes and variations in installation, monitoring

changes and variations in starting and/or completion dates

variations of warranty/guarantee/liability terms and conditions

variations in exclusions and terms of trade.



## **Unit Sector(s)**

Not applicable.

## **PRSTS319A Modify and repair security equipment/system**

### **Modification History**

Not applicable.

### **Unit Descriptor**

This competency standard covers the skills and knowledge required to conduct minor modifications and repairs on a range of security equipment and systems. It requires the ability to diagnose and rectify common basic faults and refer more complex faults for specialist attention. This work applies to extra-low voltage environments and would be carried out under limited supervision within organisational guidelines.

**Functional Area:** Elective, Technical Security

This competency standard covers the skills and knowledge required to conduct minor modifications and repairs on a range of security equipment and systems. It requires the ability to diagnose and rectify common basic faults and refer more complex faults for specialist attention. This work applies to extra-low voltage environments and would be carried out under limited supervision within organisational guidelines.

**Functional Area:** Elective, Technical Security

### **Application of the Unit**

Not applicable.

### **Licensing/Regulatory Information**

Not applicable.

### **Pre-Requisites**

Not applicable.

### **Employability Skills Information**

Not applicable.

### **Elements and Performance Criteria Pre-Content**

Not applicable.

## Elements and Performance Criteria

### Elements and Performance Criteria

Element	Performance Criteria
1 Prepare for maintenance	<p>1.1 Maintenance requirements of security equipment and systems are checked and confirmed against work order</p> <p>1.2 Tools, equipment and materials are selected appropriate to job requirements and checked to ensure safe and efficient operation</p> <p>1.3 Potential and existing risks and hazards in the workplace are risk assessed and controlled in accordance with legislative and OHS requirements</p> <p>1.4 Suitable personal protective equipment is selected, used and maintained according to OHS and organisational requirements</p>
2 Carry out maintenance	<p>2.1 Security equipment / system to be modified or repaired is accessed in accordance with manufacturer's specifications and organisational requirements with minimal disruption to client or property</p> <p>2.2 Common faults in security equipment / system are diagnosed and appropriate repairs or modifications are carried out in accordance with manufacturer's specifications</p> <p>2.3 Complex faults and repair requirements are identified and reported for specialist attention in accordance with organisational requirements</p> <p>2.4 All work is conducted using safe operating practices in accordance with OHS, legislative and organisational requirements</p> <p>2.5 Maintenance work is completed in accordance with designated timeframes and work order instructions</p>
3 Complete and document maintenance activities	<p>3.1 Equipment / system components are reassembled and tested for correct operation according to manufacturer's specifications and accepted practice</p> <p>3.2 Work area, tools and equipment are cleaned, maintained and stored in accordance with</p>

organisational requirements

- 3.3 Malfunctions, faults, wear or damage to tools and equipment are reported to facilitate repair or replacement in accordance with organisational policy and procedures
- 3.4 Waste from service and repair activities is collected, treated and disposed or recycled in accordance with organisational and environmental requirements
- 3.5 Relevant information is accurately documented, processed and maintained in accordance with industry, legislative and organisational requirements

## Required Skills and Knowledge

Not applicable.

## Evidence Guide

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to modify and repair security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### What critical aspects are required for evidence of competency?

Effectively prepare for maintenance to security equipment/system including selecting tools and equipment appropriate to job requirements and identifying possible risks and hazards in the work area.

Access security equipment/system with minimal disruption to client, conduct tests and confirm status and repair requirements.

Accurately repair or modify security equipment/system using safe operating practices and complete within designated timeframes.

Clean work area, store tools and equipment and complete all relevant documentation.

### What specific knowledge is needed to achieve the performance criteria?

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

types, functions and specifications of security equipment/systems and principles of operation

security equipment/system repair techniques  
fault finding techniques  
welding, grinding and oxy-acetylene cutting principles and procedures  
types, characteristics and functions of tools and equipment  
electrical concepts (voltages, current, resistance, impedance)  
cable identification and handling requirements  
security equipment/system configurations and methods of programming  
requirements for installation and modification of security equipment/systems  
requirements for commissioning of security equipment/systems  
relevant licensing, legislative and OHS requirements  
safe work practices and their importance.

**What specific skills are needed to achieve the performance criteria?**

To achieve the performance criteria, some specific skills are required. These include the ability to:

provide efficient and effective customer service (liaise, consult, provide and gain feedback)  
read and interpret specifications, charts and diagrams  
read and interpret a multimeter  
prioritise and methodically organise work  
trouble shoot, solve routine problems  
identify and diagnose faults and malfunctions  
identify and refer complex faults  
use appropriate testing equipment  
repair and/or modify security equipment/systems  
program and configure security equipment/systems  
commission security equipment/systems  
safely handle cable voltage, current, resistance and impedance  
apply basic carpentry and fitting, soldering, welding, and drilling  
apply safe and efficient work practices  
obtain appropriate licensing.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.  
Access to plain English version of relevant statutes and procedures.  
Assignment instructions, work plans and schedules, policy documents and duty statements.  
Assessment instruments, including personal planner and assessment record book.

Access to a registered provider of assessment services.

### **What is required to achieve consistency of performance?**

For valid and reliable assessment of this unit, the competency should be demonstrated over a period of time and observed by the assessor. The competency is to be demonstrated in a range of situations, which may include involvement in related activities normally experienced in the workplace.

Evidence of underpinning knowledge understanding of processes and principles can be gained through thorough questioning and by observation of previous work.

### **Assessment against this unit may involve the following:**

Continuous assessment in a setting that simulates the conditions of performance described in the elements, performance criteria and range of variables statement that make up the unit.

Continuous assessment in the workplace, taking into account the range of variables affecting performance.

Self-assessment on the same terms as those described above.

Simulated assessment or critical incident assessment, provided that the critical incident involves assessment against performance criteria and an evaluation of underpinning knowledge and skill required to achieve the required performance outcomes.

### **Key competency levels**

There are a number of processes that are learnt throughout work and life which are required in all jobs. They are fundamental processes and generally transferable to other work functions. Some of these are covered by the key competencies, although others may be added.

Information below highlights how these processes are applied in this competency standard.

**1** - perform the process

**2** - perform and administer the process

**3** - perform, administer and design the process

How can **communication of ideas and information** be applied? **(1)**

Work order instructions and methods to repair or modify security equipment/systems may be verified with the supervisor or work team.

How can **information be collected, analysed and organised**? **(1)**

Test results, diagnosis, repair recommendations, and repairs or modifications undertaken may be documented for reference and organised by records and reports.

How are **activities planned and organised**? **(1)**

Tests and maintenance activities may be planned and co-ordinated around client and work schedules or sequenced as required.

How can **team work** be applied? **(1)**

Additional information and advice may be sought from colleagues/supervisor to assist the accurate diagnosis of common faults and appropriate repair procedures to be undertaken.

How can the use of **mathematical ideas and techniques** be applied? **(1)**

Mathematical techniques may be used to plan and schedule work tasks and estimate resource requirements.

How can **problem solving skills** be applied? (1)

Complex faults may be accurately identified and promptly referred for specialist advice.

How can the **use of technology** be applied? (1)

Technology may be used to communicate, organise schedules, maintain records, and troubleshoot performance problems.

The Evidence Guide identifies the requirements to be demonstrated to confirm competence for this unit. Assessment must confirm sufficient ability to use appropriate skills and knowledge to modify and repair security equipment/systems. Assessment of performance should be over a period of time covering all categories within the Range of Variables statements that are applicable in the learning environment.

### **What critical aspects are required for evidence of competency?**

Effectively prepare for maintenance to security equipment/system including selecting tools and equipment appropriate to job requirements and identifying possible risks and hazards in the work area.

Access security equipment/system with minimal disruption to client, conduct tests and confirm status and repair requirements.

Accurately repair or modify security equipment/system using safe operating practices and complete within designated timeframes.

Clean work area, store tools and equipment and complete all relevant documentation.

### **What specific knowledge is needed to achieve the performance criteria?**

Knowledge and understanding are essential to apply this standard in the workplace, to transfer the skills to other contexts and to deal with unplanned events. The knowledge requirements for this competency standard are listed below:

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types, characteristics and functions of tools and equipment

electrical concepts (voltages, current, resistance, impedance)

cable identification and handling requirements

security equipment/system configurations and methods of programming

requirements for installation and modification of security equipment/systems

requirements for commissioning of security equipment/systems

relevant licensing, legislative and OHS requirements

safe work practices and their importance.

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- read and interpret a multimeter
- prioritise and methodically organise work
- trouble shoot, solve routine problems
- identify and diagnose faults and malfunctions
- identify and refer complex faults
- use appropriate testing equipment
- repair and/or modify security equipment/systems
- program and configure security equipment/systems
- commission security equipment/systems
- safely handle cable voltage, current, resistance and impedance
- apply basic carpentry and fitting, soldering, welding, and drilling
- apply safe and efficient work practices
- obtain appropriate licensing.

**What resources may be required for assessment?**

Access to a suitable venue and equipment.

Access to plain English version of relevant statutes and procedures.

Assignment instructions, work plans and schedules, policy documents and duty statements.

Assessment instruments, including personal planner and assessment record book.

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Continuous assessment in the workplace, taking into account the range of variables affecting performance.



Self-assessment on the same terms as those described above.

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Mathematical techniques may be used to plan and schedule work tasks and estimate resource requirements.

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Technology may be used to communicate, organise schedules, maintain records, and troubleshoot performance problems.

## Range Statement

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

### **Maintenance may include:**

minor modifications

repairs

servicing.

### **Security equipment may include:**

detection devices

audible and visual warning devices

cameras, monitors and control equipment

control panels, intercoms

wireless equipment, car alarms

electronic readers, electronic recognition controls

locks and locking systems

grills, lighting, boom gates, turnstiles

bank pop-up screens

biometrics

electric and mechanical fire safety and fire locking systems

power supplies, batteries

security doors and door controls.

### **Security systems may be:**

electronic

mechanical

computerised.

### **Work order instructions may relate to:**

work schedules

completion dates

job requirements and tasks

specific client requirements

access to site and specific site requirements

resource requirements

OHS requirements, compliance with relevant legislation  
organisational policies and procedures  
budget allocations.

**Tools and equipment may include:**

computer, software  
test equipment (multimeter)  
hand and power tools, fixing tools  
wire strippers  
file, drill, lockpick, pick gun  
glass break tester  
soldering iron, welder, crimp tools, IDC tools  
ladder, hoist  
batteries  
personal protective equipment  
communications equipment.

**Materials may include:**

parts and components  
security equipment/systems  
wire and cable  
fixings, solder, insulation tape  
springs, pins, graphite powder  
oil, silicon, grease, glass cleaner/lens cleaner  
glue, paint, patch materials  
electronic components, sealing compounds  
cleaning compounds.

**Workplace risks and hazards may include:**

non-compliance with maintenance and repair codes and regulations  
exposed electrical wiring  
live power  
other identified OHS risks (asbestos, dust, noise) .

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:  
Occupational Health and Safety  
environmental issues

equal employment opportunity  
industrial relations  
anti-discrimination and diversity

licensing requirements  
Australian Standards, quality assurance and certification requirements  
relevant industry Codes of Practice  
award and enterprise agreements  
trade practices  
privacy requirements  
freedom of information.

**Personal protective equipment and clothing may include:**

masks  
safety boots  
head protection  
safety glasses  
knee pads  
gloves  
warning hats, flashing lights, warning signs and tapes  
fire extinguisher, first aid kit.

**Organisational requirements may relate to:**

legal and organisational policy and procedures including personnel practices and guidelines  
organisational goals, objectives, plans, systems and processes  
legislation relevant to the operation, incident and/or response  
employer and employee rights and responsibilities  
business and performance plans  
policies and procedures relating to own role, responsibility and delegation  
quality and continuous improvement processes and standards  
client service standards  
defined resource parameters  
Occupational Health and Safety policies, procedures and programs  
emergency and evacuation procedures  
duty of care, code of conduct, code of ethics  
access and equity policy, principles and practice

records and information systems and processes  
communication channels and reporting procedures.

**Modifications may include:**

change in system capabilities and functions  
locations and positions  
monitoring.

**Repairs may be made:**

remotely  
on site.

**Access to security equipment/systems may involve:**

use of access code  
disablement of system  
removal of housing  
access token  
keys  
phone line access  
modem.

**Manufacturers specifications may be found in:**

printed instruction leaflets  
operators manuals  
equipment specifications  
attached to the equipment  
plans and diagrams  
warranty documents.

**Clients may include:**

owner  
property agent  
tenant  
building supervisor  
manager  
project manager  
agent  
government and legal instruments/agencies.

**Faults may be:**

electronic  
software  
mechanical  
procedural  
result of operational misuse  
environmental  
result of previous mis-installation.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines  
working safely around tools and equipment  
hazard recognition  
emergency procedures  
awareness of electrical hazards  
follow confined spaces procedures  
first aid.

**Relevant information may relate to:**

completion of work log  
equipment/system fault diagnosis  
repairs and modifications undertaken  
recommended repairs  
warranty conditions and allowances  
testing and commissioning results  
materials used, parts and components replaced  
recommendations for future operation and maintenance  
costings  
indemnity.

The Range of Variables provides information about the context in which the unit of competency is carried out. It allows for different work practices and work and knowledge requirements as well as for differences between organisations and workplaces. The following variables may be present for this particular unit:

**Maintenance may include:**

minor modifications  
repairs  
servicing.

**Security equipment may include:**

detection devices  
audible and visual warning devices  
cameras, monitors and control equipment  
control panels, intercoms  
wireless equipment, car alarms  
electronic readers, electronic recognition controls  
locks and locking systems  
grills, lighting, boom gates, turnstiles  
bank pop-up screens  
biometrics  
electric and mechanical fire safety and fire locking systems  
power supplies, batteries  
security doors and door controls.

**Security systems may be:**

electronic  
mechanical  
computerised.

**Work order instructions may relate to:**

work schedules  
completion dates  
job requirements and tasks  
specific client requirements  
access to site and specific site requirements  
resource requirements  
OHS requirements, compliance with relevant legislation  
organisational policies and procedures  
budget allocations.

**Tools and equipment may include:**

computer, software  
test equipment (multimeter)  
hand and power tools, fixing tools  
wire strippers  
file, drill, lockpick, pick gun  
glass break tester

soldering iron, welder, crimp tools, IDC tools

ladder, hoist

batteries

personal protective equipment

communications equipment.

**Materials may include:**

parts and components

security equipment/systems

wire and cable

fixings, solder, insulation tape

springs, pins, graphite powder

oil, silicon, grease, glass cleaner/lens cleaner

glue, paint, patch materials

electronic components, sealing compounds

cleaning compounds.

**Workplace risks and hazards may include:**

non-compliance with maintenance and repair codes and regulations

exposed electrical wiring

live power

other identified OHS risks (asbestos, dust, noise) .

**Applicable legislation, codes and national standards may relate to:**

relevant Commonwealth/State/Territory legislation which affect organisational operation:

Occupational Health and Safety

environmental issues

equal employment opportunity

industrial relations

anti-discrimination and diversity

licensing requirements

Australian Standards, quality assurance and certification requirements

relevant industry Codes of Practice

award and enterprise agreements

trade practices

privacy requirements



freedom of information.

**Personal protective equipment and clothing may include:**

masks

safety boots

head protection

safety glasses

knee pads

gloves

reflective hats, flashing lights, warning signs and tapes

fire extinguisher, first aid kit.

**Organisational requirements may relate to:**

legal and organisational policy and procedures including personnel practices and guidelines

organisational goals, objectives, plans, systems and processes

legislation relevant to the operation, incident and/or response

employer and employee rights and responsibilities

business and performance plans

policies and procedures relating to own role, responsibility and delegation

quality and continuous improvement processes and standards

client service standards

defined resource parameters

Occupational Health and Safety policies, procedures and programs

emergency and evacuation procedures

duty of care, code of conduct, code of ethics

access and equity policy, principles and practice

records and information systems and processes

communication channels and reporting procedures.

**Modifications may include:**

change in system capabilities and functions

locations and positions

monitoring.

**Repairs may be made:**

remotely

on site.

**Access to security equipment/systems may involve:**

use of access code

disablement of system

removal of housing

access token

keys

phone line access

modem.

**Manufacturers specifications may be found in:**

printed instruction leaflets

operators manuals

equipment specifications

attached to the equipment

plans and diagrams

warranty documents.

**Clients may include:**

owner

property agent

tenant

building supervisor

manager

project manager

agent

government and legal instruments/agencies.

**Faults may be:**

electronic

software

mechanical

procedural

result of operational misuse

environmental

result of previous mis-installation.

**Safe operating practices may include:**

working safely around electrical wiring, cables and overhead power lines

working safely around tools and equipment

hazard recognition

emergency procedures

awareness of electrical hazards

follow confined spaces procedures

first aid.

**Relevant information may relate to:**

completion of work log

equipment/system fault diagnosis

repairs and modifications undertaken

recommended repairs

warranty conditions and allowances

testing and commissioning results

materials used, parts and components replaced

recommendations for future operation and maintenance

costings

indemnity.

**Unit Sector(s)**

Not applicable.

## SIRXSLS201 Sell products and services

### Modification History

The version details of this endorsed unit are in the table below. The latest information is at the top.

Release	Comments
First Release	This is a revised unit, based on and equivalent to SIRXSLS001A Sell products and services.

### Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to sell products and services in a retail environment.

It involves the use of sales techniques and encompasses key selling skills, from approaching the customer to closing the sale.

It requires a basic level of product knowledge and the recognition and demonstration of verbal and non-verbal communication skills to determine customer requirements, sell the benefits of products and services, overcome objections and close sales.

Personal evaluation is used to maximise sales, according to industry codes of practice, relevant legislation and store policy.

### Application of the Unit

This unit applies to frontline sales personnel.

### Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement.

### Pre-Requisites

Nil

## Employability Skills Information

This unit contains employability skills.

## Elements and Performance Criteria Pre-Content

### Elements and Performance Criteria

Element	Performance criteria
Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.
1. Develop and apply product knowledge.	<p>1.1.Develop <b><i>product knowledge</i></b> by accessing <b><i>relevant sources of information</i></b> and confirm with relevant staff.</p> <p>1.2.Apply knowledge of the use and application of relevant products and services in interactions with customers according to store policy and <b><i>legislative requirements</i></b>.</p> <p>1.3.Identify gaps in product knowledge and resolve by accessing relevant sources of information.</p>
2. Approach customer.	<p>2.1.Identify <b><i>customers</i></b> by name where possible.</p> <p>2.2.Develop knowledge of customer buying behaviour by accessing relevant sources of information.</p> <p>2.3.Determine and apply appropriate timing of customer approach according to store policy and customer behaviour.</p> <p>2.4.Initiate customer contact according to store policy.</p> <p>2.5.Convey a positive impression to encourage customer interest according to store policy.</p>
3. Gather and respond to information.	<p>3.1.Apply questioning techniques and listening skills to determine customer buying motives and requirements.</p> <p>3.2.Interpret and clarify non verbal communication cues.</p> <p>3.3.Direct customer to specific merchandise according to customer requirements and store policy.</p>
4. Sell benefits.	<p>4.1.Match customer needs to appropriate products and services.</p> <p>4.2.Communicate knowledge of product features and benefits clearly to customers.</p> <p>4.3.Describe product use and safety requirements to customers.</p> <p>4.4.Refer customers to appropriate product specialist as required.</p> <p>4.5.Answer <b><i>routine customer questions</i></b> about merchandise accurately and honestly or refer to senior sales staff.</p>

- |                                  |   |
|----------------------------------|---|
| 5. Overcome objections.          | 5.1. Identify and acknowledge customer objections according to store policy.  |
|                                  | 5.2. Categorise objections into price, time and merchandise characteristics and consider solutions.                                   |
|                                  | 5.3. Offer solutions to customer objections according to store policy.  |
|                                  | 5.4. Apply <b>problem solving</b> within personal scope of responsibilities to overcome customer objections or refer to senior staff. |
| 6. Close sale.                   | 6.1. Monitor, identify and respond appropriately to customer buying signals.  |
|                                  | 6.2. Encourage customer to make purchase decisions.   |
|                                  | 6.3. Select and apply appropriate method of closing sale.   |
| 7. Maximise sales opportunities. | 7.1. Recognise and apply opportunities for making additional <b>sales</b> according to store policy.                                  |
|                                  | 7.2. Advise customer of complementary products or services according to customer's identified need.                                   |
|                                  | 7.3. Review personal sales outcomes and consider strategies to maximise future sales in consultation with relevant staff.             |

## Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

### Required skills

- communication and interpersonal skills to:
  - handle difficult customers
  - verbal and non-verbal communication skills to:
    - question, listen and observe
    - overcome objections and close sale
- literacy and numeracy skills to:
  - handle payments for goods
  - read product information
  - read store policies and procedures
  - record information
  - weigh and measure goods
- selling skills to use a range of selling techniques

### Required knowledge

- customer types and needs, including:
  - customer behaviour and cues

- customer buying motives
- demographics, lifestyle and income
- individual and cultural differences
- types of customer needs, such as:
  - functional
  - psychological
- relevant industry codes of practice, legislation and statutory requirements relating to the sale of products and services
- selling techniques, including:
  - add-ons and complementary sales
  - closing techniques
  - opening techniques
  - overcoming customer objections
  - recognising buying signals
  - using strategies to focus customer on specific merchandise
- specific product knowledge for area or section
- store merchandise and service range
- store policies and procedures in regard to:
  - allocated duties and responsibilities
  - selling products and services and sales performance

## Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

### **Critical aspects for assessment and evidence required to demonstrate competency in this unit**

Evidence of the following is essential:

- applies product knowledge and uses appropriate sales approach to sell the benefits of products and services, overcome objections and close sales
- uses questioning, listening and observation skills to determine customer requirements
- applies store policies and procedures in regard to selling products and services
- maximises sales opportunities according to store policies and procedures
- applies industry codes of practice, relevant legislation and statutory requirements in regard to selling products and services
- evaluates personal sales performance to maximise future

sales.

**Context of and specific resources for assessment**

Assessment must ensure access to:

- a real or simulated retail work environment
- relevant documentation, such as policy and procedures manuals
- a range of customers with different requirements
- a range of merchandise and products appropriate to the retail workplace
- product labels and sources of product information.

**Method of assessment**

A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit:

- observation of the candidate in the workplace
- customer feedback
- answers to questions about specific skills and knowledge
- review of portfolios of evidence and third-party workplace reports of on-the-job performance.

**Guidance information for assessment**

Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

## Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the individual, accessibility of the item, and local industry and regional contexts) may also be included.

***Product knowledge*** may include:

- features and benefits
- handling and storage requirements
- price
- safety features
- stock availability
- use-by dates
- warranties.

***Relevant sources of information*** may include:

- demonstrations
- internet
- labels
- product profiles



- Legislative requirements** may include:
- staff members
  - store or supplier product manuals
  - store tours
  - videos.
  - industry codes of practice
  - liquor laws
  - lottery legislation
  - work health and safety (WHS)
  - sale of second-hand goods
  - sale of X and R-rated products
  - tobacco laws
  - Australian consumer law and fair trading Acts
  - trading hours
  - transport, storage and handling of goods.
- Customers** may include:
- customers with routine or special requests
  - internal and external contacts
  - new or repeat contacts
  - people from a range of social, cultural and ethnic backgrounds
  - people with varying physical and mental abilities.
- Routine customer questions** may relate to:
- availability
  - features and benefits
  - price and price reductions
  - quality.
- Problem solving** may be affected by:
- resource implications
  - store policies and procedures.
- Sales transactions** may be completed:
- face-to-face
  - online
  - over the telephone.

## Unit Sector(s)

Cross-Sector

## Competency Field

Sales

## TLILIC0012A Licence to operate a vehicle loading crane (capacity 10 metre tonnes and above)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit Descriptor</b>	This unit specifies the outcomes required to operate a vehicle loading crane with a capacity of 10 metre tonnes or more, mounted on a vehicle for the principle purpose of loading and unloading such a vehicle, including the application of load estimation and slinging techniques to move a load, for licensing purposes.
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### Application of the Unit

<b>Application of the Unit</b>	<p>This unit requires the operator to plan the work, conduct routine checks, set up crane, transfer loads and shut down and secure crane.</p> <p>This unit is based on the requirements of the National Standard for Licensing Persons Performing High Risk Work.</p> <p>This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.</p>
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

Not Applicable

## Employability Skills Information

<b>Employability Skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

<i>Elements describe the essential outcomes of a unit of competency</i>	<i>Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.</i>
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan work	<p>1.1 Potential workplace <b><i>hazards</i></b> are identified</p> <p>1.2 <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment</p> <p>1.3 The weight of the load is identified and estimated in consultation with <b><i>associated personnel</i></b> (where applicable)</p> <p>1.4 Suitable lifting points on the load are identified in consultation with <b><i>associated personnel</i></b></p> <p>1.5 Appropriate <b><i>lifting equipment</i></b> is obtained following consultation with <b><i>associated personnel</i></b></p> <p>1.6 <b><i>Crane</i></b> is <b><i>appropriate</i></b> to the load/s and workplace conditions</p> <p>1.7 Appropriate paths for the movement of loads in the work area are inspected and determined</p> <p>1.8 Appropriate <b><i>communication methods</i></b> are identified with <b><i>associated personnel</i></b></p>
2. Conduct routine checks	<p>2.1 <b><i>Crane</i></b> is visually checked for any damage or defects</p> <p>2.2 All <b><i>signage and labels</i></b> are visible and legible according to the <b><i>appropriate standard</i></b>.</p> <p>2.3 Routine pre-operational crane checks are carried out according to <b><i>procedures</i></b></p>

ELEMENT	PERFORMANCE CRITERIA
	<p>2.4 All <b>controls</b> are located and identified</p> <p>2.5 Crane <b>service logbook</b> is checked for compliance</p> <p>2.6 <b>Crane</b> is started according to <b>procedures</b> and checked for any abnormal noises</p> <p>2.7 All crane <b>safety devices</b> are tested according to <b>procedures</b></p> <p>2.8 Post-start operational checks are carried out according to <b>procedures</b></p> <p>2.9 All <b>communication equipment</b> is checked for serviceability</p> <p>2.10 All damage and defects are reported and recorded according to <b>procedures</b>, and appropriate action is taken</p>
3. Set up crane	<p>3.1 <b>Ground suitability</b> is checked</p> <p>3.2 <b>Crane</b> is driven to the work area according to <b>procedures</b></p> <p>3.3 <b>Crane</b> is positioned for work application and <b>stability</b> according to <b>procedures</b></p> <p>3.4 Boom/jib and configuration data is input into the crane computer (as required)</p> <p>3.5 Appropriate <b>hazard prevention/control measures</b> are applied to the work area according to <b>procedures</b></p> <p>3.6 All <b>communications equipment</b> is tested for functionality</p> <p>3.7 <b>Lifting equipment</b> is prepared for load according to <b>procedures</b></p> <p>3.8 <b>Load destination</b> is prepared</p>
4. Transfer loads	<p>4.1 Loads are determined within the capacity of the crane</p> <p>4.2 Boom/jib and hoist block is positioned over load following directions from <b>associated personnel</b></p> <p>4.3 <b>Lifting equipment</b> is attached and secured using <b>defined techniques</b> according to <b>procedures</b></p> <p>4.4 <b>Test lift</b> is carried out according to <b>procedures</b></p> <p>4.5 Loads are transferred using all <b>relevant crane movements</b> according to <b>procedures</b> and the <b>appropriate standard</b></p> <p>4.6 All required <b>communication signals</b> are correctly interpreted according to <b>procedures</b> and the <b>appropriate standard</b></p>

ELEMENT	PERFORMANCE CRITERIA
	<p>4.7 The load is landed ensuring stability and security from movement</p> <p>4.8 <b>Lifting equipment</b> is removed or disconnected from load and/or lifting hook according to <b>procedures</b> (where applicable)</p> <p>4.9 <b>Crane</b> is operated according to <b>procedures</b></p> <p>4.10 Load movement is monitored constantly ensuring safety to personnel and load, and crane stability</p> <p>4.11 <b>Unplanned and/or unsafe</b> situations are responded to in line with <b>procedures</b></p>
5. Shut down and secure crane	<p>5.1 <b>Crane</b> boom/jib and equipment are stowed and secured according to <b>procedures</b> and the <b>appropriate standard</b></p> <p>5.2 Relevant motion locks and brakes are applied (where applicable)</p> <p>5.3 Outriggers/stabilisers are stowed and secured according to <b>procedures</b></p> <p>5.4 Plates or packing are stowed and secured.</p> <p>5.5 <b>Crane</b> is <b>shut down</b> according to <b>procedures</b></p> <p>5.6 Routine post-operational crane checks are carried out according to <b>procedures</b></p> <p>5.7 <b>Lifting equipment</b> is stored according to <b>procedures</b> and the <b>appropriate standards</b></p> <p>5.8 All damage and defects are reported and recorded according to <b>procedures</b>, and appropriate action is taken</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

*This describes the essential skills and knowledge and their level required for this unit.*

#### Required skills:

- Accurately record and maintain information relating to crane operations
- Use communication techniques in the workplace including hand signals, whistles and two-way radios
- Use interpersonal communication skills at a level sufficient to communicate with

## REQUIRED SKILLS AND KNOWLEDGE

other site personnel

- Operate crane including all functions to their maximum extension in the loading and unloading of loads to the safe working rated capacity of the crane, in conjunction with other associated personnel
- Use of lifting equipment and basic slinging techniques suitable for the loads to be loaded/unloaded as defined by workplace procedures
- Apply risk assessment and hazard control strategies, including hierarchy of control as applied to the positioning and safe operation of the vehicle loading crane (particular awareness of the risks associated with overhead powerlines/electrical cables, ground conditions and vehicle tipping)
- Use and interpret crane manufacturer's specifications and data, including load charts to enable the vehicle loading crane to be configured for the load
- Verify problems and equipment faults and demonstrate appropriate response procedures

### Required knowledge:

- Appropriate mathematical procedures for estimation of loads
- Assessment of ground conditions to confirm that the site is suitable (e.g. firm, level and safe) to operate the crane
- Awareness of the boom/jib movements and particularly the safe positioning of the operator for any lift
- Commonwealth, state or territory OH&S legislation, standards and codes of practice relevant to the full range of processes for the crane class
- Use of lifting equipment and basic slinging techniques suitable for the loads to be loaded/unloaded as defined by workplace procedures
- Understanding of the hierarchy of hazard identification and control
- Level of literacy to be able to read and comprehend manufacturer's instructions, procedures and safety signs
- Organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- Procedures for the recording, reporting and maintenance of workplace records and information
- Typical routine problems encountered in the process and with equipment and adjustments required for correction
- Crane characteristics and capabilities to allow the configuration of the crane to suit the range of loads

## Evidence Guide

### EVIDENCE GUIDE

## EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for the Training Package.*

### Overview of assessment

- Successful assessment of this unit meets the competency requirement of the National Standard for Licensing Persons Performing High Risk Work.
- State/territory OH&S regulators have mandated the use of Assessment Instruments and Instructions for Assessment for this unit which have been endorsed by the national body responsible for OH&S matters.

### Critical aspects for assessment and evidence required to demonstrate competency in this unit

- Compliance with OH&S licensing legislation.
- Communicate and work safely with others in the work area.
- Assessment of ground conditions to confirm that the site is suitable (e.g. firm, level and safe) to operate the vehicle loading crane.
- Risk assessment and hazard control strategies, including hierarchy of control as applied to the positioning and safe operation of the vehicle loading crane (particular awareness of the risks associated with overhead powerlines/electrical cables, ground conditions, wind, pedestrians and tipping).
- Set up, position stabilise and operate a vehicle loading crane including all functions to their maximum extension in the loading and unloading of loads to the safe working rated capacity.
- Move loads from the vehicle to the ground and/or ground to the vehicle as described in the endorsed assessment tool.
- Appropriate mathematical procedures for estimation of loads.
- Use of lifting equipment and basic slinging techniques suitable for the loads to be loaded/unloaded as defined in the workplace procedures.
- Awareness of the boom/jib movements and particularly the safe positioning of the operator for any lift.

### Context of and specific resources for assessment

- Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.
- Assessment of performance must be undertaken

## EVIDENCE GUIDE

	<p>either in the workplace or in a realistically simulated workplace setting.</p> <ul style="list-style-type: none"> <li>Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</li> <li>Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>Assessment is to comply with appropriate standard requirements.</li> <li>Applicants must have access to: <ul style="list-style-type: none"> <li>Personal Protective Equipment (PPE) for the purpose of the Performance Assessment</li> <li>appropriate vehicle loading crane (10 metre tonne or more) and associated equipment in safe condition</li> <li>appropriate lifting gear in safe condition</li> <li>Suitable loads as specified by the endorsed Assessment Instrument</li> <li>communication equipment (e.g. two-way radios, whistles, etc.)</li> <li>other associated personnel to sling and direct the loads.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>Assessment must be conducted using the endorsed Assessment Instruments. These Instruments provide advice on their application.</li> <li>The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</li> <li>Assessment may be in conjunction with the assessment of other units of competency.</li> <li>Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for assessment</b>	<ul style="list-style-type: none"> <li>Further information about endorsed Assessment Instruments may be obtained from state/territory OH&amp;S regulators.</li> </ul>



## Range Statement

### RANGE STATEMENT

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.*

<b>Hazards</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• ground stability (e.g. ground condition, recently filled trenches, slopes)</li> <li>• overhead hazards (e.g. powerlines, service pipes)</li> <li>• traffic (e.g. pedestrians, vehicles, other plant)</li> <li>• Insufficient lighting</li> <li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li> <li>• positioning of crane operator</li> <li>• other specific hazards (e.g. dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <ol style="list-style-type: none"> <li>1 elimination</li> <li>2 substitution</li> <li>3 isolation</li> <li>4 engineering control measures</li> <li>5 using safe work practices</li> <li>6 personal protective equipment</li> </ol>
<b>Appropriate standards</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards especially AS2550.1 - 2002 (6.5)</li> <li>• manufacturer's specifications</li> <li>• industry standards</li> </ul>
<b>Associated personnel</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• doggers</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• riggers</li> </ul>
<b>Lifting equipment</b>	<p>May include but not be limited to:</p> <ul style="list-style-type: none"> <li>• chain slings</li> <li>• wire and synthetic slings</li> <li>• shackles</li> <li>• eyebolts</li> </ul>
<b>Crane</b>	<p>A crane with a capacity of 10 metre tonnes and above mounted on a vehicle for the principle purpose of loading and unloading such a vehicle</p>
<b>Appropriate</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• crane capabilities</li> <li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li> </ul>
<b>Communication method</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding</li> <li>• appropriate worksite protocol</li> </ul>
<b>Signage and labels</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• crane data plates/labels</li> <li>• load charts</li> <li>• crane decals</li> <li>• control labels</li> </ul>
<b>Procedures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• manufacturer's guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures</li> <li>• workplace procedures (work instructions, operating procedures, checklists)</li> </ul>
<b>Controls</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• luffing levers</li> <li>• knuckling levers</li> <li>• hoisting and lowering levers</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• slewing levers including brake</li> <li>• boom extension levers (where fitted)</li> </ul>
<b>Service logbook</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• any logbook</li> <li>• service book</li> <li>• history record system where the service and maintenance history is kept</li> </ul>
<b>Crane safety devices</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• horns/sirens</li> <li>• audible and visual warning devices</li> <li>• lights</li> </ul>
<b>Communication equipment</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• fixed frequency two-way radios</li> <li>• whistles</li> </ul>
<b>Ground suitability</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• rough uneven ground</li> <li>• backfilled ground</li> <li>• soft soils</li> <li>• hard compacted soil</li> <li>• rock</li> <li>• bitumen</li> <li>• concrete</li> </ul>
<b>Stability</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• deploying outriggers</li> <li>• establishing correct size plates or packing</li> <li>• correctly positioning plates or packing</li> </ul>
<b>Hazard prevention/control measures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• traffic barricades and controls</li> <li>• pedestrian controls</li> <li>• trench covers</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>adequate illumination</li> </ul>
<b>Load destination</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>ground</li> <li>vehicles</li> </ul>
<b>Defined techniques</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>fixed lifting points</li> <li>basic reeved slings</li> </ul>
<b>Test lift</b>	<p>The load is lifted just clear of the lifting plane to allow for checks to be safely made in consultation with associated personnel to ensure that:</p> <ul style="list-style-type: none"> <li>near capacity loads do not overload the crane</li> <li>loads of unusual shape or weight distribution are correctly slung</li> <li>load measuring equipment can be used to verify the calculated weight of the load</li> <li>all equipment is functioning properly</li> <li>adjustments to the slinging can be made in a safe manner</li> </ul>
<b>Relevant crane movements</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>luffing</li> <li>slewing</li> <li>knuckling</li> <li>telescoping</li> <li>raise and lower hoist</li> </ul>
<b>Communication signals</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>stop - hand</li> <li>stop - whistle</li> <li>hoist up - hand</li> <li>hoist up - whistle</li> <li>hoist down - hand</li> <li>hoist down - whistle</li> <li>luff boom down - hand</li> <li>luff boom down - whistle</li> <li>luff boom up - hand</li> <li>luff boom up - whistle</li> <li>telescope out - hand</li> <li>telescope out - whistle</li> </ul>

RANGE STATEMENT	
	<ul style="list-style-type: none"><li>• telescope in - hand</li><li>• telescope in - whistle</li></ul>
<b>Unplanned and/or unsafe situations</b>	May include but not limited to: <ul style="list-style-type: none"><li>• failure/loss of control (e.g. brakes and steering)</li><li>• failure of equipment (e.g. hydraulic system)</li><li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li></ul>
<b>Shut down</b>	May include but not limited to: <ul style="list-style-type: none"><li>• retracting boom/jib (where applicable)</li><li>• retracting hoist rope and hook block</li><li>• folding boom/jib into the transport position</li><li>• retracting outriggers/stabilisers</li><li>• idling engine to stabilise temperature</li><li>• turning off engine (where applicable)</li><li>• removing key from ignition (where applicable)</li><li>• locking and securing cabin (where applicable)</li><li>• securing crane for travel</li></ul>

## Unit Sector(s)

Not Applicable

## TLILIC2001A Licence to operate a forklift truck

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit Descriptor</b>	This unit specifies the outcomes required for the operation of a powered industrial truck equipped with a mast and an elevating load carriage to which is attached a pair of fork arms or other attachment, for licensing purposes. This definition also includes a truck on which the operator is raised with the attachment for order-picking.
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### Application of the Unit

<b>Application of the Unit</b>	<p>THIS UNIT REQUIRES THE OPERATOR TO BE ABLE PLAN THE WORK, CONDUCT ROUTINE CHECKS ON THE FORKLIFT, SHIFT LOADS IN A SAFE MANNER, AND SHUT DOWN AND SECURE THE EQUIPMENT AFTER THE COMPLETION OF OPERATIONS.</p> <p>This unit is based on the National Standard for Licensing Persons Performing High Risk Work.</p> <p>This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.</p>
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

Not Applicable

## Employability Skills Information

Employability Skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Not Applicable

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.</i>
1. Plan work	1.1 Potential workplace <b><i>hazards</i></b> are identified 1.2 <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment 1.3 Appropriate <b><i>forklift</i></b> truck is selected according to the load and workplace conditions 1.4 Working area is inspected to determine appropriate path of movement for loads and forklift truck 1.5 <b><i>Communication methods</i></b> are identified according to <b><i>procedures</i></b>
2. Conduct routine checks	2.1 Forklift is visually checked for any damage or defects 2.2 All <b><i>signage and labels</i></b> are visible and legible according to the <b><i>appropriate standard</i></b> 2.3 All controls are located and identified 2.4 <b><i>Pre-start operational checks</i></b> are carried out according to <b><i>procedures</i></b> 2.5 <b><i>Forklift</i></b> is started according to <b><i>procedures</i></b> and checked for any abnormal noise  2.6 <b><i>Post-start operational checks</i></b> are carried out according to <b><i>procedures</i></b> 2.7 All forklift functions and safety devices are tested to their maximum according to <b><i>procedures</i></b>

	2.8 Defects and damage are reported and recorded according to <b>procedures</b> , and appropriate action is taken
3. Shift load	<p>3.1 The weight of load is assessed to ensure compliance with <b>forklift</b> truck data plate specifications</p> <p>3.2 Appropriate <b>hazard prevention/control measures</b> are implemented and communicated with personnel in the work area</p> <p>3.3 <b>Forklift</b> is operated at a safe speed and according to <b>procedures</b></p> <p>3.4 Loads are moved and placed to ensure stability of material and avoidance of hazards</p> <p>3.5 Load movement is monitored constantly ensuring safety to personnel and load, and structural stability</p> <p>3.6 <b>Unplanned and/or unsafe situations</b> are responded to in line with <b>procedures</b></p>
4. Shut down and secure forklift truck	<p>4.1 <b>Forklift</b> truck is parked to avoid hazards</p> <p>4.2 Forklift is <b>shut down</b> according to <b>procedures</b></p> <p>4.3 Routine post-operational forklift checks are carried out according to <b>procedures</b></p> <p>4.4 Forklift is secured to prevent unauthorised access/use</p> <p>4.5 All defects and damage are reported and recorded according to <b>procedures</b>, and appropriate action is taken</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

*This describes the essential skills and knowledge and their level required for this unit.*

#### Required skills:

- Accurately interpret information relating to conducting forklift truck operations (e.g. procedures)
- Safely conduct forklift truck operations including all functions to the maximum height and load capacity
- Identify hazards associated with the operation of the forklift truck, assess risks and put into place effective hazard prevention/control measures for those hazards identified
- Use communication skills at a level sufficient to communicate with other site personnel (e.g. receive and interpret work instructions, safety information, emergency procedures)



**REQUIRED SKILLS AND KNOWLEDGE**

- Drive forklift with load in forward and reverse, maintaining visibility
- Verify problems and equipment faults and demonstrate appropriate response procedures

**Required knowledge:**

- Methodology of determining the weight of a load
- Commonwealth, state or territory OH&S legislation, standards relevant to the safe operation for the forklift trucks
- Understanding of forklift characteristics and capabilities (including use of load data plates)
- Understanding of the hierarchy of hazard identification and control
- Organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- Procedures for the recording, reporting and maintenance of workplace records and information
- Forklift truck operations and safe operating techniques
- Typical routine problems encountered in the operation of the crane and equipment and adjustments required for correction

**Evidence Guide****EVIDENCE GUIDE**

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for the Training Package.*

**Overview of assessment**

- Successful assessment of this unit meets the competency requirement of the National Standard for Licensing Persons Performing High Risk Work.
- State/territory OH&S regulators have mandated the use of Assessment Instruments and Instructions for Assessment for this unit which have been endorsed by the national body responsible for OH&S matters.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

- Compliance with OH&S licensing legislation.
- Communicate and work safely with others in the work area.
- Identify hazards associated with the operation of the forklift truck and put in place effective hazard controls for those hazards identified.

<b>EVIDENCE GUIDE</b>	
	<ul style="list-style-type: none"> <li>• Conduct pre-start-up, operational, moving loads and shut down and secure checks of the forklift truck according to procedures.</li> <li>• Operate the forklift truck and move loads safely, including driving and manoeuvring, picking up and placing of loads at various stack heights.</li> <li>• Drive forklift truck with load in forward and reverse, maintaining visibility.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of the safe application of knowledge and skills to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.</li> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Applicants must have access to: <ul style="list-style-type: none"> <li>• Personal Protective Equipment (PPE) for the purpose of the Performance Assessment</li> <li>• associated equipment appropriate to forklift truck operations</li> <li>• suitable loads as described by the endorsed Assessment Instrument</li> <li>• manufacturers specifications</li> <li>• appropriate forklift truck in a safe condition.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must be conducted using the endorsed Assessment Instrument. These Instruments provide instruction on their application.</li> <li>• The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</li> <li>• Assessment may be in conjunction with the assessment of other units of competency.</li> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for</b>	<ul style="list-style-type: none"> <li>• Further information about endorsed Assessment Instruments may be obtained from state/territory</li> </ul>

**EVIDENCE GUIDE****assessment**

OH&amp;S regulators.

**Range Statement****RANGE STATEMENT**

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.*

**Hazards**

May include but not limited to:

- ground conditions (e.g. condition of pavement, slopes)
- overhead hazards (e.g. powerlines, service pipes)
- insufficient lighting
- traffic (e.g. pedestrians, vehicles, other plant)
- weather (e.g. wind, lightning, rain)
- forklift instability (e.g. overloading, poor load placement, irregular loads)
- other hazards (e.g. dangerous materials)

**Hazard control measures**

Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls

It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:

- 1 elimination
- 2 substitution
- 3 isolation
- 4 engineering control measures
- 5 using safe work practices
- 6 personal protective equipment

**Appropriate standards**

May include but not limited to:

- legislation
- Australian standards
- manufacturer's specifications
- industry standards (where applicable)

<b>RANGE STATEMENT</b>	
<b>Forklift truck</b>	<p>May include but not be limited to:</p> <ul style="list-style-type: none"> <li>• counterbalanced</li> <li>• reach trucks</li> <li>• rough terrain</li> <li>• internal combustion petrol, diesel, gas</li> <li>• electric</li> </ul>
<b>Communications methods</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding</li> <li>• appropriate worksite protocol</li> </ul>
<b>Procedures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• manufacturer's guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures</li> <li>• workplace procedures (work instructions, operating procedures, checklists)</li> </ul>
<b>Pre-start operational checks</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• safety devices fitted where appropriate</li> <li>• forklift data plate fitted and interpreted</li> <li>• logbook, handbook or operating manuals available</li> <li>• external visual check including, evidence of damage, leaks, visual evidence of structural weaknesses (including paint separation or stressed welds) is carried out</li> <li>• forklift attachment is checked for security</li> <li>• approved modifications and/or attachments fitted to manufacturer's specifications (e.g. as per forklift or attachment data plate) are identified</li> <li>• checks for adaptations or modifications outside manufacturer's specifications (e.g. not listed on the forklift or attachment data plate) are carried out</li> <li>• maintenance logbook/records checked</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Post-start operational checks</b>	<p>May include checks of the forklift truck and equipment after start-up to ensure:</p> <ul style="list-style-type: none"> <li>• hazard warning systems (for example lights and horns), are functional</li> <li>• attachment movements and control functions are smooth and comply with operating requirements</li> <li>• steering, transmission and brake functions comply with operating requirements</li> </ul>
<b>Hazard prevention/control measures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• barricades and traffic control</li> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• pedestrian control (barricades, signs, etc.)</li> <li>• excavation safeguards</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> </ul>
<b>Unplanned and/or unsafe situations</b>	<p>May include but not limited:</p> <ul style="list-style-type: none"> <li>• failure/loss of control (e.g. brakes and steering)</li> <li>• failure of equipment (e.g. hydraulic system)</li> <li>• environmental condition</li> </ul>
<b>Shut down</b>	<p>May include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• parking in a suitable location away from dangerous areas</li> <li>• fork arms are correctly positioned (tips down, tilted forward, lowered to ground)</li> <li>• appropriate transmission/gear is selected for parking (relevant to transmission type)</li> <li>• hand/parking brake is applied</li> <li>• engine power is turned off</li> <li>• ignition key is removed (if applicable)</li> <li>• LPG gas cylinder valve is shut off (where fitted)</li> <li>• securing equipment against unauthorised operation</li> <li>• securing the site</li> <li>• ensuring access ways are clear</li> <li>• identifying and segregating defective equipment</li> </ul>

**RANGE STATEMENT**

	<ul style="list-style-type: none"><li>and reporting to authorised personnel</li><li>batteries are connected to the charger (if applicable)</li></ul>
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**Unit Sector(s)**

Not Applicable

## TLILIC2002A Licence to operate an order picking forklift truck

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit Descriptor</b>	This unit specifies the outcomes required to operate a powered industrial truck of a type where the operator's control arrangement is incorporated with the load carriage/lifting media, and elevates with it, for licensing purposes.
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### Application of the Unit

<b>Application of the Unit</b>	<p>THIS UNIT REQUIRES THE OPERATOR TO BE ABLE PLAN THE WORK, CONDUCT ROUTINE CHECKS, SHIFT LOADS AND SHUT DOWN AND SECURE FORKLIFT.</p> <p>This unit is based on the requirements of the National Standard for Licensing Persons Performing High Risk Work.</p> <p>This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.</p>
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

Not Applicable

## Employability Skills Information

<b>Employability Skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

<i>Elements describe the essential outcomes of a unit of competency</i>	<i>Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.</i>
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan work	1.1 Potential workplace <b><i>hazards</i></b> are identified 1.2 <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment 1.3 <b><i>Safety equipment</i></b> is identified for workplace conditions 1.4 <b><i>Forklift</i></b> is appropriate to the load and workplace conditions 1.5 Appropriate paths for movement of loads are determined for the workplace conditions 1.6 Appropriate <b><i>communication methods</i></b> are identified according to <b><i>procedures</i></b>
2. Conduct routine checks	2.1 <b><i>Forklift</i></b> is visually checked for any damage or defects 2.2 All <b><i>signage and labels</i></b> are visible and legible according to the <b><i>appropriate standard</i></b> 2.3 All controls are located and identified 2.4 <b><i>Pre-start operational checks</i></b> are carried out according to <b><i>procedures</i></b>  2.5 <b><i>Forklift</i></b> is started according to <b><i>procedures</i></b> and checked for any abnormal noises



ELEMENT	PERFORMANCE CRITERIA
	<p>2.6 <i>Post-start operational checks</i> are carried out according to <i>procedures</i></p> <p>2.7 All <i>forklift safety devices</i> are tested according to <i>procedures</i></p> <p>2.8 All defects and damage are reported and recorded according to <i>procedures</i>, and appropriate action is taken</p>
3. Shift load	<p>3.1 Appropriate <i>hazard prevention/control measures</i> are implemented and communicated with personnel in the work area</p> <p>3.2 The weight of load is assessed to ensure compliance with <i>forklift</i> data plate</p> <p>3.3 <i>Forklift</i> is operated at a safe speed and according to <i>procedures</i></p> <p>3.4 Work is conducted safely at heights including safe and efficient use of <i>safety equipment</i>. (where applicable)</p> <p>3.5 Materials are placed on the pallet to ensure safety and stability and avoidance of hazards</p> <p>3.6 Load movement is monitored constantly ensuring safety to personnel and load, and <i>forklift</i> stability</p> <p>3.7 <i>Unplanned and/or unsafe situations</i> are responded to in line with <i>procedures</i></p>
4. Shut down and secure forklift	<p>4.1 <i>Forklift</i> is parked to avoid hazards</p> <p>4.2 <i>Forklift</i> is <i>shut down</i> according to <i>procedures</i></p> <p>4.3 Routine post-operational <i>forklift</i> checks are carried out according to <i>procedures</i></p> <p>4.4 <i>Forklift</i> is secured to prevent unauthorised access/use</p> <p>4.5 All defects and damage are reported and recorded according to <i>procedures</i>, and appropriate action is taken</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

*This describes the essential skills and knowledge and their level required for this unit.*

## REQUIRED SKILLS AND KNOWLEDGE

### Required skills:

- Effectively operate an order picking forklift truck including all functions to the maximum height and load capacity
- Use hazard identification skills, including identifying those associated with the operation of the order picking forklift truck risk assessment and putting into place effective hazard prevention/control measures for those hazards
- Use interpersonal communication skills at a level sufficient to communicate with other site personnel (e.g. receive and interpret work instructions, safety information, emergency procedures)
- Interpret and accurately record information relating to conducting order picking forklift truck operations (e.g. operating instructions, procedures and service logbook)
- Use problem solving skills to verify problems and equipment faults and demonstrate appropriate response procedures
- Use interpersonal communication skills at a level sufficient to communicate with other site personnel (e.g. receive and interpret work instructions, safety information, emergency procedures)

### Required knowledge:

- Commonwealth, state or territory OH&S legislation, standards and codes of practice relevant to the full range of processes for the order picking forklift truck
- Rated capacity and working load limits identification
- Estimation or determination of load weight from labels, markings or load paperwork
- Order picking forklift truck capabilities, limitations and gear
- Order picking forklift truck operations and operating techniques
- Organisational and workplace standards, requirements, policies and procedures for conducting operations for the order picking forklift truck
- Procedures for the recording, reporting and maintenance of workplace records and information
- Typical routine problems encountered in the process and with equipment and adjustments required for correction

## Evidence Guide

### EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and*

**EVIDENCE GUIDE**

*the assessment guidelines for the Training Package.*

**Overview of assessment**

- Successful assessment of this unit meets the competency requirement of the National Standard for Licensing Persons Performing High Risk Work.
- State/territory OH&S regulators have mandated the use of Assessment Instruments and Instructions for Assessment for this unit which have been endorsed by the national body responsible for OH&S matters.

**Critical aspects for assessment and evidence required to demonstrate competency in this unit**

- Compliance with OH&S licensing legislation.
- Effectively communicate and work safely with others in the work area.
- Identify hazards associated with the operation of the order picking forklift truck and put in place effective hazard prevention/controls for those hazards.
- Effectively conduct pre-start, post-start operational checks and shut down checks of the order picking forklift truck.
- Effectively operate the forklift, pick and place loads safely at various heights, including driving and manoeuvring and placing loads in a safe manner.

**Context of and specific resources for assessment**

- Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.
- Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace.
- Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.
- Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.
- Assessment is to comply with relevant appropriate standard requirements.
- Applicants must have access to:
  - Personal Protective Equipment (PPE) for the purpose of the Performance Assessment.

EVIDENCE GUIDE	
	<ul style="list-style-type: none"> <li>• safety equipment in safe condition as appropriate</li> <li>• associated equipment appropriate to order picking forklift truck operations</li> <li>• suitable loads as described by the endorsed Assessment Instrument</li> <li>• appropriate forklift in a safe condition.</li> </ul>
Method of assessment	<ul style="list-style-type: none"> <li>• Assessment must be conducted using the endorsed Assessment Instruments. These Instruments provide advice on their application.</li> <li>• The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</li> <li>• Assessment may be in conjunction with the assessment of other units of competency.</li> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstances, but is able to be transferred to other circumstances.</li> </ul>
Guidance information for assessment	<ul style="list-style-type: none"> <li>• Further information about endorsed Assessment Instruments may be obtained from state/territory OH&amp;S regulators.</li> </ul>

## Range Statement

RANGE STATEMENT	
<p><i>The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.</i></p>	
Hazards	<p>May include:</p> <ul style="list-style-type: none"> <li>• ground conditions (e.g. condition of surface, slopes)</li> <li>• overhead hazards (e.g. powerlines, service pipes)</li> <li>• traffic (e.g. pedestrians, vehicles, other plant)</li> <li>• environmental conditions (e.g. wind, lightning, rain)</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• order picking forklift instability (e.g. overloading, poor load placement, irregular loads)</li> <li>• other specific hazards (e.g. falling from platform, dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <ol style="list-style-type: none"> <li>1 elimination</li> <li>2 substitution</li> <li>3 isolation</li> <li>4 engineering control measures</li> <li>5 using safe work practices</li> <li>6 personal protective equipment</li> </ol>
<b>Appropriate standards</b>	<p>Appropriate standards may include:</p> <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards</li> <li>• manufacturer's specifications</li> </ul>
<b>Forklift</b>	Powered industrial truck of a type where the operator's control arrangement is incorporated with the load carriage/lifting media, and elevates with it
<b>Communication method</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding, and appropriate worksite protocol</li> </ul>
<b>Procedures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• manufacturer's guidelines (instructions, specifications or checklists)</li> <li>• industry operating procedures</li> <li>• workplace procedures (work instructions, operating procedures, checklists)</li> </ul>

<b>RANGE STATEMENT</b>	
<b>Signage and labels</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• forklift data plates/labels</li> <li>• forklift warning decals</li> <li>• control labels</li> </ul>
<b>Pre-start up checks</b>	<p>May include, but are not limited to ensuring that:</p> <ul style="list-style-type: none"> <li>• safety equipment checks</li> <li>• safety devices/alarms are fitted and operational</li> <li>• order picking forklift data plate is fitted and interpreted</li> <li>• logbook, handbook or operating manuals are available</li> <li>• fluid checks</li> <li>• battery charge checks</li> <li>• evidence of damage, leaks, visual evidence of structural weaknesses (including paint separation or stressed welds) is sought through an external visual check</li> <li>• approved modifications and/or attachments are fitted to manufacturer's specifications (e.g. as per order picking forklift data plate)</li> <li>• checks for adaptations or modifications outside manufacturer's specifications (e.g. not listed on the order picking forklift data plate) are made</li> <li>• records are updated as required</li> </ul>
<b>Post-start operational checks</b>	<p>May include checks of the order picking forklift truck and equipment to ensure:</p> <ul style="list-style-type: none"> <li>• hazard warning systems (for example lights and horns) are functional</li> <li>• control functions are smooth and comply with operating requirements</li> <li>• start-up is to procedures</li> </ul>
<b>Safety devices</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• safety gates and interlocks</li> <li>• reversing beepers</li> <li>• flashing lights</li> <li>• emergency descent device (hydraulic)</li> <li>• deadman switch</li> </ul>
<b>Hazard prevention/control measures</b>	<p>May include:</p>

**RANGE STATEMENT**

	<ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• traffic barricades and control</li> <li>• pedestrian barricades</li> <li>• bridging plates</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> </ul>
<b>Safety equipment</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• harnesses</li> <li>• lanyard</li> <li>• appropriate attachment point</li> </ul>
<b>Unplanned and/or unsafe situations</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• failure/loss of control (e.g. brakes and steering)</li> <li>• failure of equipment (e.g. hydraulic system)</li> <li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li> </ul>
<b>Shut down</b>	<p>May include, but is not limited to:</p> <ul style="list-style-type: none"> <li>• forks are lowered to the ground</li> <li>• brakes and motion locks are applied (where applicable)</li> <li>• motor power is turned off</li> <li>• order picking forklift is secured against unauthorized movement</li> <li>• ignition key is removed (if applicable)</li> <li>• batteries are connected to the charger (if applicable)</li> </ul>

**Unit Sector(s)**

Not Applicable

## TLILIC3003A Licence to operate a bridge and gantry crane

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit Descriptor</b>	This unit specifies the outcomes required to operate a bridge and gantry crane. It does not cover the types that are controlled from a location remote to a permanent cabin/control station on the crane and that have three or less powered operations, that is hoist/raise and lower is one operation, for licensing purposes.
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### Application of the Unit

<b>Application of the Unit</b>	<p>This unit requires the operator to plan the work, conduct routine checks, transfer loads, and shut down and secure crane.</p> <p>This unit is based on the requirements of the National Standard for Licensing Persons Performing High Risk Work.</p> <p>This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.</p>
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

Not Applicable



## Employability Skills Information

<b>Employability Skills</b>	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

<i>Elements describe the essential outcomes of a unit of competency</i>	<i>Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.</i>
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## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Plan work	1.1 Potential <b><i>hazards</i></b> are identified in the workplace 1.2 <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment 1.3 Weight (mass) of the load is estimated in consultation with <b><i>associated personnel</i></b> 1.4 Appropriate paths for the movement of loads in the work area are determined 1.5 <b><i>Crane</i></b> is appropriate to the load/s 1.6 Appropriate <b><i>communication methods</i></b> are identified with <b><i>associated personnel</i></b>
2. Conduct routine checks	2.1 Appropriate <b><i>hazard prevention/control measures</i></b> are applied to the work area according to <b><i>procedures</i></b> 2.2 <b><i>Crane</i></b> is accessed in a safe manner 2.3 <b><i>Crane</i></b> is visually checked for any damage or defects 2.4 All <b><i>signage and labels</i></b> are visible and legible according to the <b><i>appropriate standard</i></b> 2.5 Routine pre-operational crane checks are carried out according to <b><i>procedures</i></b> 2.6 All <b><i>controls</i></b> are located and identified 2.7 Crane <b><i>service logbook</i></b> is checked for compliance 2.8 <b><i>Crane</i></b> is started according to <b><i>procedures</i></b> and

ELEMENT	PERFORMANCE CRITERIA
	<p>checked for any abnormal noises</p> <p>2.9 Crane <i>safety devices</i> are tested according to <i>procedures</i></p> <p>2.10 Post-start operational checks are carried out according to <i>procedures</i></p> <p>2.11 All <i>communication equipment</i> is checked for serviceability</p> <p>2.12 All damage and defects are reported and recorded according to <i>procedures</i>, and appropriate action is taken</p>
3. Transfer loads	<p>3.1 Hoist block is positioned over load following directions from <i>associated personnel</i></p> <p>3.2 <i>Test lift</i> is carried out according to <i>procedures</i>.</p> <p>3.3 Loads are transferred using all <i>relevant crane movements</i> according to <i>procedures</i> and the <i>appropriate standard</i></p> <p>3.4 All required <i>communication signals</i> are interpreted correctly according to <i>procedures</i> and the <i>appropriate standard</i></p> <p>3.5 <i>Crane</i> is operated according to <i>procedures</i></p> <p>3.6 Load movements are monitored constantly ensuring safety to personnel and load, and structural stability</p> <p>3.7 <i>Unplanned and/or unsafe situations</i> are responded to in line with <i>procedures</i></p>
4. Shut down and secure crane	<p>4.1 <i>Crane</i> is parked according to <i>procedures</i></p> <p>4.2 <i>Crane</i> and equipment are stowed and secured according to <i>procedures</i> and the <i>appropriate standard</i></p> <p>4.3 All relevant motion locks and brakes are applied (where applicable)</p> <p>4.4 Crane is <i>shut down</i> according to <i>procedures</i>.</p> <p>4.5 Routine post-operational crane checks are carried out according to <i>procedures</i></p> <p>4.6 <i>Hazard prevention/control measures</i> are removed (where applicable)</p> <p>4.7 All damage and defects are reported and recorded according to <i>procedures</i>, and appropriate action is taken</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

*This describes the essential skills and knowledge and their level required for this unit.*

#### Required skills:

- Accurately record and maintain information relating to bridge and gantry crane operations
- Use communication techniques in the workplace including hand signals, whistles and use of two-way radios
- Use interpersonal communication skills at a level sufficient to communicate with other site personnel
- Operate a bridge and gantry crane including all functions to their maximum for the lifting and moving of loads to the maximum rated capacity in conjunction with other associated personnel
- Apply risk assessment and hazard control strategies, including hierarchy of control as applied to the safe operation of the crane (particular awareness of the risks associated with overhead powerlines/electrical cables, access to cabin, vehicles and clear access whilst travelling)
- Use and interpret crane manufacturer's specifications and data, including maximum load to ensure the crane is not overloaded
- Verify problems and equipment faults and demonstrate appropriate response procedures

#### Required knowledge:

- Appropriate mathematical procedures for estimation of loads
- Bridge and gantry crane characteristics
- Commonwealth, state or territory OH&S legislation, standards and codes of practice relevant to the full range of processes for the crane class
- Emergency procedures including escape routes
- Level of literacy to be able to read and comprehend manufacturer's instructions, procedures and safety signs
- Understanding of the hierarchy of hazard identification and control
- Organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- Procedures for the recording, reporting and maintenance of workplace records and information
- Typical routine problems encountered in the operation of the crane and equipment and adjustments required for correction

## Evidence Guide

### EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for the Training Package.*

<b>Overview of assessment</b>	<ul style="list-style-type: none"> <li>• Successful assessment of this unit meets the competency requirement of the National Standard for Licensing Persons Performing High Risk Work.</li> <li>• State/territory OH&amp;S regulators have mandated the use of Assessment Instruments and Instructions for Assessment for this unit which have been endorsed by the national body responsible for OH&amp;S matters.</li> </ul>
<b>Critical aspects for assessment and evidence required to demonstrate competency in this unit</b>	<ul style="list-style-type: none"> <li>• Compliance with OH&amp;S licensing legislation.</li> <li>• Communicate and work safely with others in the work area.</li> <li>• Risk assessment and management procedures (particular awareness of the risks associated with overhead powerlines/electrical cables, access to cabin, other vehicles and clear access whilst travelling).</li> <li>• Conduct of pre- and post-operational checks of the bridge and gantry crane.</li> <li>• Operation of a bridge and gantry crane including all functions to their maximum capacity in the lifting and moving of loads to the maximum rated capacity in conjunction with other associated personnel.</li> <li>• Appropriate mathematical procedures for estimation of loads.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.</li> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</li> <li>• Assessment must occur under standard and authorised work practices, safety requirements and</li> </ul>

**EVIDENCE GUIDE**

	<p>environmental constraints.</p> <ul style="list-style-type: none"> <li>• Assessment is to comply with relevant appropriate standard requirements.</li> <li>• Applicants must have access to: <ul style="list-style-type: none"> <li>• Personal Protective Equipment (PPE) for the purpose of the Performance Assessment</li> <li>• appropriate bridge and gantry crane and associated equipment in safe condition</li> <li>• suitable loads as specified by the endorsed Assessment Instrument</li> <li>• communication equipment (e.g. two-way radios, whistles etc.</li> <li>• other associated personnel to sling and direct the loads.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must be conducted using the endorsed Assessment Instrument. These Instruments provide advice on their application.</li> <li>• The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</li> <li>• Assessment may be in conjunction with the assessment of other units of competency. <ul style="list-style-type: none"> <li>• Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>• Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.</li> </ul> </li> </ul>
<b>Guidance information for assessment</b>	<ul style="list-style-type: none"> <li>• Further information about endorsed Assessment Instruments may be obtained from state/territory OH&amp;S regulators.</li> </ul>

**Range Statement****RANGE STATEMENT**

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised*

**RANGE STATEMENT**

*wording, if used in the performance criteria, is detailed below.*

<b>Hazards</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• ground stability (e.g. ground condition or slopes for load placement)</li> <li>• overhead hazards (e.g. powerlines, service pipes)</li> <li>• insufficient lighting</li> <li>• traffic (e.g. pedestrians, vehicles, plant)</li> <li>• environmental conditions (e.g. wind, lightning, storms)</li> <li>• other specific hazards (e.g. dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <ol style="list-style-type: none"> <li>1 elimination</li> <li>2 substitution</li> <li>3 isolation</li> <li>4 engineering control measures</li> <li>5 using safe work practices</li> <li>6 personal protective equipment</li> </ol>
<b>Appropriate standards</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards</li> <li>• manufacturer's specifications</li> <li>• industry standards (where applicable)</li> </ul>
<b>Associated personnel</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• riggers</li> <li>• doggers</li> </ul>
<b>Crane</b>	<p>May include:</p> <ul style="list-style-type: none"> <li>• bridge crane, a bridge beam mounted at each end to an end carriage, capable of travelling along elevated runways and having one or more hoisting mechanisms arranged to traverse across the bridge</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>gantry crane, a bridge beam, supported at each end by legs mounted on end carriages, capable of travelling on supported surfaces or deck levels, whether fixed or not and which has a crab with one or more hoisting units arranged to travel across the bridge</li> </ul> <p>Bridge and gantry:</p> <ul style="list-style-type: none"> <li>excluded are cranes of the type that are controlled from a location remote to a permanent cabin/control station on the crane and that have three or less powered operations, that is hoist raise and lower is one operation</li> </ul>
<b>Communication method</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>verbal and non-verbal language</li> <li>written instructions</li> <li>signage</li> <li>hand signals</li> <li>listening</li> <li>questioning to confirm understanding</li> <li>appropriate worksite protocol</li> </ul>
<b>Signage and labels</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>crane data plates/labels</li> <li>load charts</li> <li>crane decals</li> <li>control labels</li> </ul>
<b>Procedures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>manufacturer's guidelines (instructions, specifications or checklists)</li> <li>industry operating procedures</li> <li>workplace procedures (work instructions, operating procedures, checklists)</li> </ul>
<b>Controls</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>long travel levers</li> <li>cross travel levers</li> <li>hoisting and lowering levers</li> <li>rotating hook levers (where applicable)</li> </ul>
<b>Service logbook</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>any logbook</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• service book</li> <li>• history record system where the service and maintenance history is kept</li> </ul>
<b>Safety devices</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• horns/sirens</li> <li>• audible and visual motion devices</li> <li>• operator restraint devices (where applicable)</li> <li>• lights</li> </ul>
<b>Communication equipment</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• two-way radios</li> <li>• whistles</li> <li>• bells</li> <li>• buzzers</li> </ul>
<b>Hazard prevention/control measures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• traffic barricades and controls</li> <li>• pedestrian controls</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> </ul>
<b>Test lift means</b>	<p>The load is lifted just clear of the lifting plane to allow for checks to be safely made in consultation with associated personnel to ensure that:</p> <ul style="list-style-type: none"> <li>• near capacity loads do not overload the crane</li> <li>• loads of unusual shape or weight distribution are correctly slung</li> <li>• load measuring equipment can be used to verify the calculated weight of the load</li> <li>• all crane equipment is functioning properly</li> <li>• adjustments to the slinging can be made in a safe manner</li> </ul>
<b>Relevant crane movements</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• hoisting (raise and lower)</li> <li>• traversing (moving hoisting mechanisms along bridge)</li> </ul>



<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>travelling (at minimum speed, gentle acceleration and braking, to minimise load swing)</li> </ul>
<b>Communication signals</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>stop - hand</li> <li>stop - whistle</li> <li>hoist up - hand</li> <li>hoist up - whistle</li> <li>hoist down - hand</li> <li>hoist down - whistle</li> <li>traverse - hand</li> <li>travel - hand</li> <li>creep - hand</li> </ul>
<b>Unplanned and/or unsafe situations</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>failure/loss of control (e.g. brakes and steering)</li> <li>failure of equipment (e.g. hydraulic system)</li> <li>environmental conditions (e.g. wind, lightning, storms, etc.)</li> </ul>
<b>Shut down</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>retracting hoist rope and hook block</li> <li>travelling crane to park position</li> <li>removing key from control panel (where applicable)</li> <li>locking and securing cabin (where applicable)</li> <li>isolating power to crane</li> </ul>

## Unit Sector(s)

Not Applicable

## TLILIC3006A Licence to operate a non-slewing mobile crane (greater than 3 tonnes capacity)

### Modification History

Not Applicable

### Unit Descriptor

<b>Unit Descriptor</b>	This unit specifies the outcomes required to operate a mobile crane of greater than 3 tonnes capacity that incorporates a boom or jib which includes articulated type mobile cranes and locomotive cranes, but does not include vehicle tow trucks, for licensing purposes.
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### Application of the Unit

<b>Application of the Unit</b>	<p>This unit requires the operator to plan the work, conduct routine checks, set up crane, transfer loads, mobile loads, and shut down and secure the crane.</p> <p>This unit is based on the requirements of the National Standard for Licensing Persons Performing High Risk Work.</p> <p>This unit in its current form meets state and territory licensing requirements. Any alteration will result in a unit which is not acceptable to regulators for the purpose of licensing.</p>
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### Licensing/Regulatory Information

Refer to Unit Descriptor

### Pre-Requisites

Not Applicable

## Employability Skills Information

Employability Skills	This unit contains employability skills.
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## Elements and Performance Criteria Pre-Content

Not Applicable

## Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the required performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge and/or the range statement. Assessment of performance is to be consistent with the evidence guide.</i>
1. Plan work	<p>1.1 1.1 Potential workplace <b><i>hazards</i></b> are identified</p> <p>1.2 <b><i>Hazard control measures</i></b> are identified consistent with <b><i>appropriate standards</i></b> to ensure the safety of personnel and equipment</p> <p>1.3 The weight of the load is identified and estimated in consultation with <b><i>associated personnel</i></b></p> <p>1.4 <b><i>Crane</i></b> is <b><i>appropriate</i></b> to the load/s and workplace conditions</p> <p>1.5 The appropriate path for the movement of loads in the work area is inspected and determined</p> <p>1.6 Appropriate <b><i>communication methods</i></b> are identified with <b><i>associated personnel</i></b></p>
2. Conduct routine checks	<p>2.1 Crane is visually checked for any damage or defects</p> <p>2.2 <b><i>Crane</i></b> is accessed in a safe manner</p> <p>2.3 All <b><i>signage and labels</i></b> are visible and legible according to the <b><i>appropriate standard</i></b></p> <p>2.4 Routine pre-operational crane checks are carried out according to <b><i>procedures</i></b></p> <p>2.5 All controls are located and identified</p> <p>2.6 Crane <b><i>service logbook</i></b> is checked for compliance</p> <p>2.7 Crane is started according to <b><i>procedures</i></b> and checked for any abnormal noises</p> <p>2.8 All <b><i>crane safety devices</i></b> are tested according to</p>

	<p><b><i>procedures</i></b></p> <p>2.9 Pos-start operational checks are carried out according to <b><i>procedures</i></b></p> <p>2.10 All <b><i>communication equipment</i></b> is checked for serviceability</p> <p>2.11 All damage and defects are reported and recorded according to <b><i>procedures</i></b>, and appropriate action is taken</p>
3. Set up crane	<p>3.1 <b><i>Ground suitability</i></b> is checked</p> <p>3.2 <b><i>Crane</i></b> is driven to the work area according to <b><i>procedures</i></b></p> <p>3.3 <b><i>Crane</i></b> is positioned for work application and <b><i>stability</i></b> according to <b><i>procedures</i></b></p> <p>3.4 Appropriate <b><i>crane configuration</i></b> for work task is determined according to <b><i>procedures</i></b> (where applicable)</p> <p>3.5 Boom/jib and counterweight configuration data is input into the crane computer (where applicable)</p> <p>3.6 Appropriate <b><i>hazard prevention/control measures</i></b> are applied to the work area according to <b><i>procedures</i></b></p> <p>3.7 All <b><i>communications equipment</i></b> is tested for functionality</p>
4. Transfer load	<p>4.1 Lifts are determined within the capacity of the crane</p> <p>4.2 Boom/jib and hoist block is positioned over load following directions from <b><i>associated personnel</i></b></p> <p>4.3 <b><i>Test lift</i></b> is carried out according to <b><i>procedures</i></b></p> <p>4.4 Loads are transferred using all <b><i>relevant crane movements</i></b> according to <b><i>procedures</i></b> and the <b><i>appropriate standard</i></b></p> <p>4.5 All required <b><i>communication signals</i></b> are correctly interpreted according to <b><i>procedures</i></b> and the <b><i>appropriate standard</i></b></p> <p>4.6 <b><i>Crane</i></b> is operated according to <b><i>procedures</i></b></p> <p>4.7 Load movement is monitored constantly ensuring safety to personnel and load, and crane stability</p> <p>4.8 <b><i>Unplanned and/or unsafe</i></b> situations are responded to in line with <b><i>procedures</i></b></p>
5. Mobile load	<p>5.1 Suitability of <b><i>planned route</i></b> is checked for the crane according to <b><i>procedures</i></b></p> <p>5.2 <b><i>Crane</i></b> is configured to mobile load according to <b><i>procedures</i></b></p>

	5.3 Load is moved using <b>best mobile practice</b> according to the appropriate standard
6 Shut down and secure crane	<p>6.1 <b>Crane</b> boom/jib and equipment is stowed and secured, where appropriate, according to <b>procedures</b> and the <b>appropriate standard</b></p> <p>6.2 Relevant motion locks and brakes are applied (where applicable)</p> <p>6.3 Outriggers/stabilisers are stowed and secured according to <b>procedures</b> (where applicable)</p> <p>6.4 Crane is <b>shut down</b> according to procedures</p> <p>6.5 Routine post-operational crane checks are carried out according to <b>procedures</b></p> <p>6.6 Plates or packing are stowed and secured (where applicable)</p> <p>6.7 All damage and defects are recorded and reported according to <b>procedures</b>, and appropriate action is taken</p>

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

*This describes the essential skills and knowledge and their level, required for this unit.*

#### Required skills:

- Accurately record and maintain information relating to crane operations
- Use communication techniques in the workplace including whistles, hand signals and use of two-way radios
- Use communication skills at a level sufficient to communicate with other site personnel
- Assessment of ground conditions to confirm that the site is suitable (e.g. firm, level and safe) to operate crane
- Operate crane including all functions to their maximum extension in the lifting and moving of loads to the safe working rated capacity in conjunction with other associated personnel
- Mobile loads using best mobile practice
- Apply risk assessment and hazard control strategies, including hierarchy of control as applied to the positioning and safe operation of the crane (particular awareness of the risks associated with overhead powerlines/electrical cables, ground conditions, crane tipping and demolition sites)
- Use and interpret crane manufacturer's specifications and data, including load charts

## REQUIRED SKILLS AND KNOWLEDGE

to enable the crane to be configured for the load

- Verify problems and equipment faults and demonstrate appropriate response procedures

### Required knowledge:

- Appropriate mathematical procedures for estimation and measurement of loads
- Commonwealth, state or territory OH&S legislation, standards and codes of practice relevant to the full range of processes for the crane class
- Ability to read and comprehend manufacturer's instructions, procedures and safety signs
- Understanding of crane characteristics and capabilities (including use of load charts) to allow the configuration of the crane to suit the range of loads
- Understanding of the hierarchy of hazard identification and control
- Organisational and workplace standards, requirements, policies and procedures for conducting operations for the crane class
- Procedures for the recording, reporting and maintenance of workplace records and information
- Typical routine problems encountered in the operation of the crane and equipment and adjustments required for correction

## Evidence Guide

### EVIDENCE GUIDE

*The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for the Training Package.*

#### Overview of assessment

Successful assessment of this unit meets the competency requirement of the National Standard for Licensing Persons Performing High Risk Work.

State/territory OH&S regulators have mandated the use of Assessment Instruments and Instructions for Assessment for this unit which have been endorsed by the national body responsible for OH&S matters.

#### Critical aspects for assessment and evidence required to demonstrate competency in this unit

- Compliance with OH&S licensing legislation.
- Communicate and work safely with others in the work area.
- Risk assessment and management procedures (particular awareness of the risks associated with

## EVIDENCE GUIDE

	<p>overhead powerlines/electrical cables, ground conditions, crane tipping, other vehicles and personnel).</p> <ul style="list-style-type: none"> <li>• Operation of a non-slewing mobile crane including all functions to their maximum extension in the lifting and moving of loads to the safe working rated capacity of non-slewing mobile cranes (over 3t capacity) in conjunction with other associated personnel.</li> <li>• Appropriate mathematical procedures for estimation of loads.</li> </ul>
<b>Context of and specific resources for assessment</b>	<ul style="list-style-type: none"> <li>• Assessment of the safe and effective application of knowledge and skill to workplace tasks (performance) must be undertaken using the endorsed Assessment Instrument.</li> <li>• Assessment of performance must be undertaken either in the workplace or in a realistically simulated workplace setting.</li> <li>• Assessors must ensure that the assessment in the workplace is organised to ensure that all the required equipment and materials and a suitable working area is made available to suit the assessment and the workplace.</li> <li>• Assessment must occur under standard and authorised work practices, safety requirements and environmental constraints.</li> <li>• Assessment is to comply with relevant appropriate standard requirements.</li> <li>• Applicants must have access to: <ul style="list-style-type: none"> <li>• Personal Protective Equipment (PPE) for the purpose of the Performance Assessment</li> <li>• appropriate non-slewing crane (greater than 3 tonnes) and associated equipment in safe condition</li> <li>• suitable loads as specified by endorsed assessment instrument</li> <li>• communication equipment (e.g. two-way radios, whistles, etc.)</li> <li>• other associated personnel to sling and direct the loads.</li> </ul> </li> </ul>
<b>Method of assessment</b>	<ul style="list-style-type: none"> <li>• Assessment must be conducted using the endorsed Assessment Instruments. These Instruments provide advice on their application.</li> </ul>

## EVIDENCE GUIDE

	<ul style="list-style-type: none"> <li>The use of '<b>simulators</b>' in the assessment of this unit of competency is <b>not acceptable</b>.</li> <li>Assessment may be in conjunction with the assessment of other units of competency.</li> <li>Assessment methods must confirm consistency and accuracy of performance together with application of underpinning knowledge.</li> <li>Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstances, but is able to be transferred to other circumstances.</li> </ul>
<b>Guidance information for assessment</b>	<ul style="list-style-type: none"> <li>Further information about endorsed Assessment Instruments may be obtained from state/territory OH&amp;S regulators.</li> </ul>

## Range Statement

### RANGE STATEMENT

*The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below.*

<b>Hazards</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>ground stability (e.g. ground condition, recently filled trenches, slopes)</li> <li>overhead hazards (e.g. powerlines, service pipes)</li> <li>insufficient lighting</li> <li>traffic (e.g. pedestrians, vehicles, other plant)</li> <li>environmental conditions (e.g. wind, lightning, storms, etc.)</li> <li>other specific hazards (e.g. dangerous materials)</li> </ul>
<b>Hazard control measures</b>	<p>Refers to the systematic process of eliminating or reducing the risk to personnel and property through the application of controls</p> <p>It includes the application of the hierarchy of control, the six-step preference of control measures to manage and control risk:</p> <ol style="list-style-type: none"> <li>1 elimination</li> </ol>



<b>RANGE STATEMENT</b>	
	2 substitution 3 isolation 4 engineering control measures 5 using safe work practices 6 personal protective equipment
<b>Appropriate standards</b>	May include but not limited to: <ul style="list-style-type: none"> <li>• codes of practice</li> <li>• legislation</li> <li>• Australian standards</li> <li>• manufacturer's specifications</li> <li>• industry standards (where applicable)</li> </ul>
<b>Associated personnel</b>	May include but not limited to: <ul style="list-style-type: none"> <li>• doggers</li> <li>• riggers</li> </ul>
<b>Appropriate</b>	May include but not limited to: <ul style="list-style-type: none"> <li>• crane capabilities</li> <li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li> </ul>
<b>Crane</b>	May include: <ul style="list-style-type: none"> <li>• a crane (greater than 3 tonnes capacity) which meets the requirements of AS1418</li> <li>• articulated type mobile cranes</li> <li>• locomotive cranes</li> </ul> Does not include vehicle tow truck operations
<b>Communication method</b>	May include but not limited to: <ul style="list-style-type: none"> <li>• verbal and non-verbal language</li> <li>• written instructions</li> <li>• signage</li> <li>• hand signals</li> <li>• listening</li> <li>• questioning to confirm understanding</li> <li>• appropriate worksite protocol</li> </ul>
<b>Signage and labels</b>	May include but not limited to: <ul style="list-style-type: none"> <li>• crane data plates/labels</li> <li>• load charts</li> <li>• crane decals</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>control labels</li> </ul>
<b>Procedures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>manufacturer's guidelines (instructions, specifications, operators manual or checklists)</li> <li>industry operating procedures</li> <li>workplace procedures (work instructions, operating procedures, checklists)</li> </ul>
<b>Controls</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>luffing levers</li> <li>hoisting and lowering levers</li> <li>slewing levers including brake</li> <li>boom extension levers (where fitted)</li> </ul>
<b>Service logbook</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>any logbook</li> <li>service book</li> <li>history record system where the service and maintenance history is kept</li> </ul>
<b>Crane safety devices</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>horns/sirens</li> <li>audible and visual reversing devices</li> <li>operator restraint devices</li> <li>lights</li> </ul>
<b>Communication equipment</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>fixed channel two-way radios</li> <li>whistles</li> <li>bells</li> <li>buzzers</li> </ul> <p>NB: where radio communication equipment is used the transmitting frequencies of the equipment must be selected to prevent interference to or from other radio equipment being used in the vicinity of the crane</p>
<b>Ground suitability</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>rough uneven ground</li> <li>backfilled ground</li> <li>soft soils</li> <li>hard compacted soil</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• rock</li> <li>• bitumen</li> <li>• concrete</li> </ul>
<b>Stability</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• deploying outriggers</li> <li>• establishing correct size plates or packing</li> <li>• correctly positioning plates or packing</li> </ul>
<b>Crane configuration</b>	<p>May include but not be limited to:</p> <ul style="list-style-type: none"> <li>• boom/jib</li> <li>• fly-jib</li> <li>• counterweights</li> </ul>
<b>Hazard prevention/control measures</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• safety tags on electrical switches/isolators</li> <li>• insulated powerlines</li> <li>• safety observer used inside exclusion zone</li> <li>• disconnected power</li> <li>• traffic barricades and control/s</li> <li>• pedestrian controls</li> <li>• trench covers</li> <li>• movement of obstructions</li> <li>• personal protective equipment</li> <li>• adequate illumination</li> </ul>
<b>Test lift</b>	<p>The load is lifted just clear of the lifting plane to allow for checks to be safely made in consultation with associated personnel to ensure that:</p> <ul style="list-style-type: none"> <li>• near capacity loads do not overload the crane</li> <li>• loads of unusual shape or weight distribution are correctly slung</li> <li>• load measuring equipment can be used to verify the calculated weight of the load</li> <li>• all crane equipment is functioning properly</li> <li>• adjustments to the slinging can be made in a safe manner</li> </ul>
<b>Relevant crane movements</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• telescope in and out</li> <li>• boom/jib up and down</li> <li>• articulating (as applicable)</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"> <li>• raise and lower hoist (as applicable)</li> </ul>
<b>Communication signals</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• stop - hand</li> <li>• stop - whistle</li> <li>• hoist up - hand</li> <li>• hoist up - whistle</li> <li>• hoist down - hand</li> <li>• hoist down - whistle</li> <li>• luff boom down - hand</li> <li>• luff boom down - whistle</li> <li>• luff boom up - hand</li> <li>• luff boom up - whistle</li> <li>• telescope out - hand</li> <li>• telescope out - whistle</li> <li>• telescope in - hand</li> <li>• telescope in - whistle</li> <li>• slew/articulate right - hand</li> <li>• slew/articulate right - whistle</li> <li>• slew/articulate left - hand</li> <li>• slew/articulate left - whistle</li> </ul>
<b>Unplanned and/or unsafe situations</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• failure/loss of control (e.g. brakes and steering)</li> <li>• failure of equipment (e.g. hydraulic system)</li> <li>• environmental conditions (e.g. wind, lightning, storms, etc.)</li> </ul>
<b>Planned route</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• unusual or difficult terrains</li> <li>• obstacles or obstruction</li> </ul>
<b>Best mobile practice</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• minimum speed</li> <li>• gentle acceleration and braking (to minimise load swing)</li> <li>• minimum boom/jib length</li> <li>• carrying the load near to the ground surface</li> <li>• use of handheld taglines</li> </ul>
<b>Shut down</b>	<p>May include but not limited to:</p> <ul style="list-style-type: none"> <li>• retracting boom/jib/fly (where applicable)</li> </ul>

<b>RANGE STATEMENT</b>	
	<ul style="list-style-type: none"><li>• retracting hoist rope and hook block</li><li>• idling engine to stabilise temperature</li><li>• retracting outriggers/stabilisers (where applicable)</li><li>• turning off engine</li></ul>



## **Unit Sector(s)**

Not Applicable

## UEPMNT419B Perform civil drafting

### Modification History

Not applicable.

### Unit Descriptor

#### Unit Descriptor

#### 1) Scope:

##### 1.1) Descriptor

This unit deals with the skills and knowledge required to perform the drafting and use of drawing equipment as applied to the production of sectional, arrangement, schematic and plan drawings.

### Application of the Unit

#### Application of the Unit 2)

This unit is intended to augment formally acquired competencies. It is suitable for employment-based programs under an approved contract of training.

### Licensing/Regulatory Information

#### License to practice 3)

The skills and knowledge described in this unit do not require a licence to practise in the workplace. However, practice in this unit is subject to regulations directly related to Occupational Health and Safety and where applicable contracts of training such as apprenticeships and the like.

## Pre-Requisites

**Prerequisite Unit(s)** 4)

**Competencies** 4.1)

Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must be have been completed.

Common Unit Group

Unit Code	Unit Title
UEENEEE107A	Use drawings, diagrams, schedules, standards, cords and specifications
UEENEEE101A	Apply Occupational Health Safety regulations, codes and practices in the workplace
OR	
MEM09002B	Interpret technical drawing

**Literacy and numeracy skills** 4.2)

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following levels. A description of what each level entails is provided in Section 2.3.1 Language, Literacy and Numeracy.

Reading	4	Writing	4	Numeracy	4
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## Employability Skills Information

**Employability Skills** 5)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the

**Employability Skills****5)**

qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

**Elements and Performance Criteria Pre-Content**

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element.  
Assessment of performance is to be consistent with the Evidence Guide.

**Elements and Performance Criteria****ELEMENT****PERFORMANCE CRITERIA**

1 Prepare for drafting	1.1	Work requirements are identified from request/work orders or equivalent and clarified/confirmed with appropriate parties or by site inspection
	1.2	Occupational Health and Safety standards, statutory requirements, relevant Australian standards, codes of practice, manufacturers' specifications, environmental requirements and enterprise procedures are identified, applied and monitored throughout the work procedure
	1.3	Relevant plans, drawings and texts are selected and interpreted in accordance with the work plan
	1.4	Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of the on-the-job training
2 Perform civil drafting	2.1	Civil structures and assemblies are drawn using sectional representation in accordance with specification requirements
	2.2	Structures drawn to highlight critical features in accordance with specification requirements



ELEMENT	PERFORMANCE CRITERIA
	2.3 Civil assemblies drawn to highlight critical features in accordance with specification requirements
	2.4 Progressive tolerance calculations made to ensure functional operation of civil structures and assemblies
	2.5 Dimensions selected to ensure fit of civil components in accordance with specification requirements
	2.6 Civil components selected from manufacturer's catalogue to meet specified functions
	2.7 Pictorial drawings, such as isometric, produced as requested in accordance with relevant standards
3 Complete the work	3.1 Drawings checked to ensure that assembly is possible in accordance with specification requirements
	3.2 Drawings produced, registered and recorded in accordance with instructions/site documentation procedures
	3.3 Relevant personnel notified and existing drawings/specification sheets updated as required

## Required Skills and Knowledge

### REQUIRED SKILLS AND KNOWLEDGE

8) This describes the Essential Skills and Knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired performing civil drafting.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

The extent of the Essential Knowledge and Associated Skills required follows:

KS01-PM419B Civil drafting

## REQUIRED SKILLS AND KNOWLEDGE

T1 Evidence shall show that knowledge has been acquired for safe working practices of:

- Relevant Environmental, Occupational Health and Safety legislation and regulations
- Relevant plant and equipment, its location and operation
- Technical drawings and manufacturers manuals
- Introduction to and typical arrangements of power production plant
- Relevant state and territory regulations
- Detailed drafting concepts
- Technical drawings and data
- Engineering practices (civil)
- Engineering drawing equipment
- Civil drawing symbols
- Computer Aided Drawing systems

T2 Specific skills needed to achieve the Performance Criteria:

- Apply Relevant Environmental, Occupational Health and Safety legislation and regulations
- Interpret Technical drawings and manufacturers manuals
- Apply relevant state and territory regulations
- Perform civil drafting
- Use drawing equipment
- Use Computer Aided Drawing systems
- Communicate effectively
- Apply data analysis techniques and tools.

## Evidence Guide

### EVIDENCE GUIDE

9) This provides essential advice for assessment of the competency standard unit and must be read in conjunction with the Performance Criteria and the Range Statement of unit and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this competency standard unit and shall be used in conjunction with all components parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

### Overview of Assessment 9.1)

Longitude competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry's preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practiced. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included in the Assessment Guidelines of this Training Package.

**Critical aspects of evidence required to demonstrate competency in this unit** 9.2)

Before the critical aspects of evidence are considered all pre-requisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated on at least two occasions in accordance with the "Assessment Guidelines – UEP12". Evidence shall also

comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the Performance Criteria and Range Statement
  - Apply sustainable energy principles and practices as specified in the Performance Criteria and Range Statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in 6) of this unit
  - Demonstrate an appropriate level of employability skills
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated performance across a representative range of contexts from the prescribed items below:
  - The knowledge and application of relevant sections of: Occupational Health and Safety legislation; Statutory legislation; Enterprise/site safety procedures; Enterprise/site emergency procedures
  - Detailed drafting concepts (Civil)
  - Engineering practices (Civil)
  - Use of engineering drawing equipment
  - Dealing with an unplanned event by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

**Context of and  
specific  
resources for  
assessment**      **9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

Competency Standards should be assessed in the workplace or simulated workplace and under the normal range of workplace

conditions.

Assessment of this unit will be supported with documentary evidence, by means of endorsement stating type and application of work.

In addition to the resources listed above in Context of assessment, evidence should show competency working, in limited spaces, with different types of plant and equipment as well as different structural/construction types and methods and in a variety of environments.

#### **Method of assessment**

#### **9.4)**

This unit shall be assessed by methods given in 1.3.00 Assessment Guidelines.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

#### **Concurrent assessment and relationship with other units**

#### **9.5)**

There are no recommended concurrent assessments with this unit, however in some cases efficiencies may be gained in terms of learning and assessment effort being concurrently managed with allied competency standard units where listed.

Nil

## **Range Statement**

### **RANGE STATEMENT**

**10)** This relates to the competency standard unit as a whole providing the range of

## RANGE STATEMENT

contexts and conditions to which the Performance Criteria apply. It allows for different work environments and situations that will affect performance.

Relevant legislation, standards or codes of practice may apply.

Dimensions may be notated in metric or imperial units.

Drawings may utilise perspective, explosive view or hidden view techniques.

Types of structures drafted may include foundations, plinths, dams, canals, spillways, flumes and roads.

Drawing equipment used may include Computer Aided Drafting (CAD) and conventional drawing tools.

Standard symbols are used.

Generic terms are used throughout this Training Package for vocational standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms are given in Section 2.1 Preliminary Information and Glossaries.

## Unit Sector(s)

Not applicable.

## Competency Field

**Competency Field** 11)

Maintenance.